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DEPARTMENTAL COMMITTEE FOR METEOROLOGICAL SERVICES

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NATIONAL SEVERE LOCAL STORMS OPERATIONS PLAN

SUBCOMMITTEE ON BASIC METEOROLOGICAL SERVICES
WASHINGTON
JANUARY 1969

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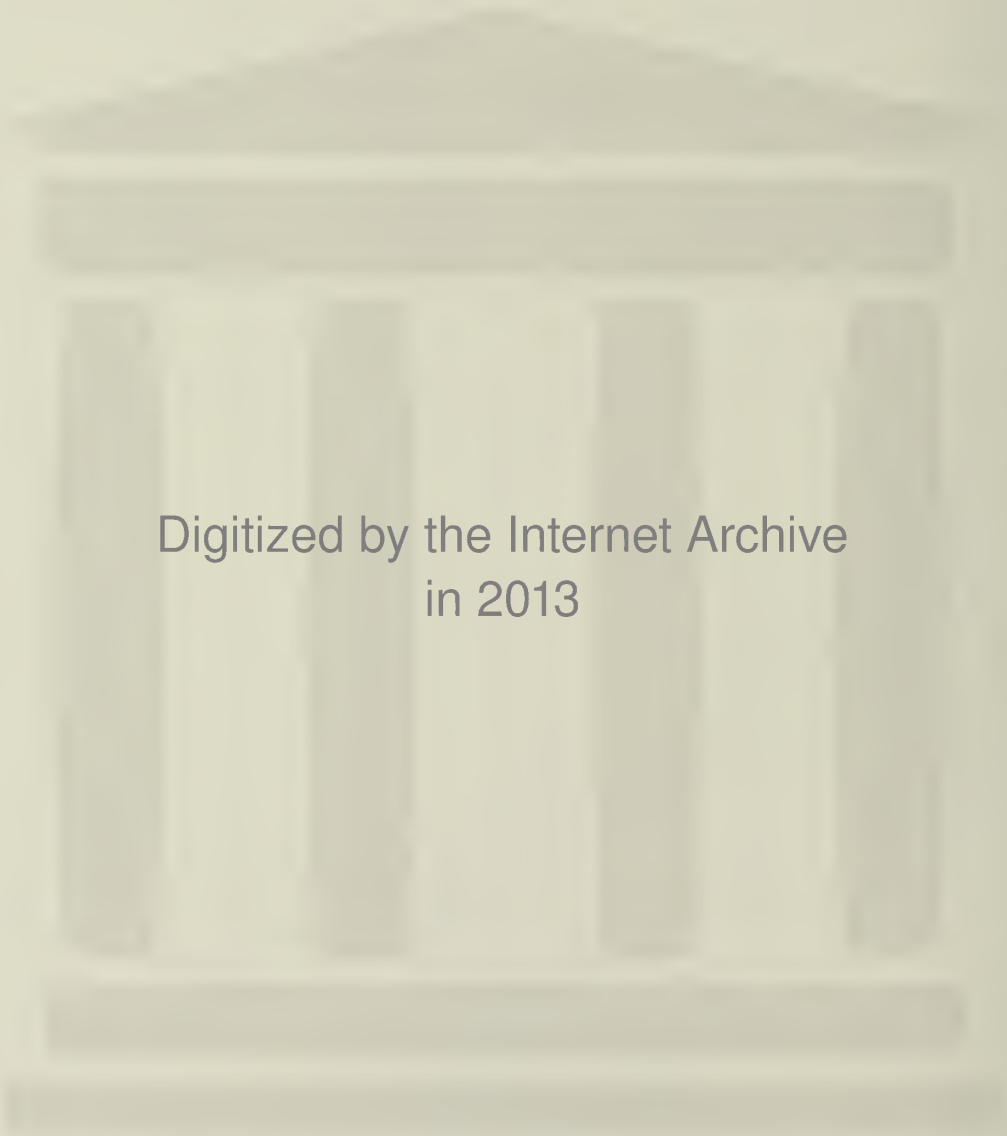
NATIONAL SEVERE LOCAL STORMS OPERATIONS PLAN

Prepared by

Subcommittee on Basic Meteorological Services

Supersedes National Severe Local Storms
Operations Plan - 1968

Washington, D. C.
January 1969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NATIONAL SEVERE LOCAL STORMS OPERATIONS PLAN

Foreword

A memorandum dated March 6, 1967 from the Federal Coordinator for Meteorological Services and Supporting Research requested the Interdepartmental Committee for Meteorological Services (ICMS) to arrange for an Annual Severe Local Storms Conference to produce an annual Operations Plan similar to that now prepared for hurricanes. ICMS at its meeting in March 1967 considered the above recommendation and assigned the task of implementation to the Subcommittee on Basic Meteorological Services (SC/BMS). The SC/BMS at its meeting on May 15, 1967 established an Ad Hoc Group on Severe Local Storms Conferences and Plans. The recommendations to this committee were to standardize terminology, adjust criteria to a common base and review procedures.

To meet this request the following Interdepartmental Severe Local Storms Conferences were held at Kansas City, Missouri.

First - October 24-26, 1967
Second - September 25-26, 1968

This National Severe Local Storms Operations Plan supersedes the 1968 PLAN and describes the responsibilities of the cooperating agencies and implements the recommendations of the conferences. It is issued in loose leaf form; future revisions to the PLAN will be made by page changes. The total PLAN will be reissued every five or six years.

NATIONAL SEVERE LOCAL STORMS OPERATIONS PLAN

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CHAPTER 1

RESPONSIBILITIES OF COOPERATING AGENCIES

1. ESSA Weather Bureau.

a. General. The ESSA Weather Bureau has the statutory responsibility for providing a severe local storm warning service in the conterminous United States, Alaska and Hawaii. Although the Weather Bureau has the responsibility for providing such a service for all 50 states, the extremely low frequency of severe local storms in Alaska and Hawaii does not justify establishment of a similar service for these states.

This warning service is for use by the general public and general and commercial aviation and is provided through the National Severe Storms Forecast Center (NSSFC) Kansas City; local Weather Bureau Offices (WBO); and Weather Bureau Forecast Offices (WBFO) with Flight Advisory Weather Service (FAWS) Units which perform the following functions.

b. National Severe Storms Forecast Center (NSSFC).

(1) A continuous watch on the possibility of severe local storm development in the conterminous United States will be maintained at all times. Any special rawinsonde, pibal and other weather observations needed during the course of this watch are authorized and will be requested in accordance with special instructions. NSSFC will arrange for the entry of all such observations received by them on all RAWARC circuits.

(2) Public and Aviation Severe Weather Watch Bulletins are issued as required. These bulletins will be numbered serially per calendar year, with Aviation Severe Weather Watch Bulletins (WW) and Public Severe Weather Watch Bulletins each having a separate numbering system.

(3) If it is necessary to cancel a watch, a separate, serially numbered bulletin which is in consonance with the numbering system of the original watch will be issued. It will be called a Tornado (Severe Thunderstorm) Watch Cancellation Bulletin" or an "Aviation Severe Weather Watch Cancellation Bulletin," as appropriate. The bulletin cancelling a public watch will specify the numbered watch and geographical area cancelled. A bulletin cancelling an aviation watch will usually specify only the number of the watch cancelled. If the original WW contained more than one severe weather watch area, the cancellation bulletin will give the area number, if only one area is being cancelled.

(4) A brief status report on the development or lack of development of the severe weather forecast in each aviation severe weather watch will be prepared. These will be prepared at three-hourly intervals, with the first one being prepared three hours after the issuance time of the watch. The report will be called "Status Report on WW NR____" and transmitted as an appropriate separate message on all Service A and RAWARC circuits.

(5) The responsibility for the issuance of all-clears for all or any part of the aviation severe weather watch area rests with SELS and should be based on consideration of all available data. All-clears should be issued in a logical sequence at two or three hourly intervals as the weather situation moves through successive parts of the watch area. If the threat of severe weather is ending rapidly in sections of the watch area, the two hour interval is preferable, if not oftener. Such releases will be designated as "All-clear Information on WW Number _____." When SELS cancels an aviation severe weather watch via a cancellation bulletin, it will not be necessary to send a status report or all-clear message. All-clear information on the same or another WW may be included with a status report.

(6) The National Hurricane Center and appropriate Hurricane Warning Office are contacted two hours before the scheduled time of release of an advisory or bulletin if tropical cyclone induced tornadoes are expected. SELS will issue Aviation Severe Weather Watch Bulletins but not public tornado watches for tornadoes anticipated in areas where Hurricane Warning Offices are issuing advisories and/or bulletins. Such information will be included in the appropriate advisory or bulletin. Whenever a critical tornado situation develops between the normal times advisories or bulletins are issued, a special bulletin is issued promptly by the appropriate Hurricane Warning Office. SELS will promptly issue a corresponding WW.

(7) All public severe weather watch bulletins are distributed to all Weather Bureau stations on RAWARC and via telephone to those WB stations that do not have RAWARC.

(8) All Aviation Severe Weather Watch Bulletins are transmitted on Service "A" and all RAWARC circuits.

(9) The Radar Analysis and Development Unit (RADU) of NSSFC issues hourly radar summaries (SD-1) for Service "A" teletypewriter transmission. Sixteen radar summary charts are prepared and transmitted daily on the National Facsimile Circuit.

(10) The Communications Unit has the responsibility for relaying severe weather information (reports of severe local storms, warnings, severe weather statements) received on one RAWARC Circuit to any other designated RAWARC Circuit. All reports of severe local storms received on Service A will be relayed to all RAWARC Circuits.

(11) Follow-up information such as all-clear and forecast guidance material are issued after a watch is distributed, to keep all offices fully informed of important changes in trends resulting from special analyses. This will normally be done via the Status Reports and all-clear information issued on WWs.

(12) The Severe Local Storms Synopsis (SELS SYNS) and Severe Weather Outlook Narrative (AC) are prepared for appropriate teletypewriter dissemination. The Severe Weather Outlook Graphic is prepared for facsimile dissemination. These outlooks describe the most likely areas of

thunderstorm and severe thunderstorm development. The AC is prepared daily, while the SELS SYNS and Severe Weather Outlook Graphic is prepared daily from February 1 - August 31 and as required the rest of the year.

(13) A mean wind vector of the winds between the surface and 200 mbs for all areas covered by aviation and public watches will be prepared. This vector will be transmitted as part of the E section of the pertinent Aviation Severe Weather Watch Bulletin. Format will be "Mean Wind Vector DDDFF," where DDD is the direction to the nearest 5 degrees and FF the wind speed to nearest 5 knots.

c. Weather Bureau Offices.

(1) Public Severe Weather Watch Bulletins will be distributed immediately to the public in accordance with each office's county responsibility plan whenever a threat to any part of the area of county responsibility is indicated by the bulletin. In order to help the public determine which areas are affected by the watch, the affected areas are restated in terms of counties, geographical areas or prominent cities. Publications and distribution of various types of material have made the public aware of the Weather Bureau's warning service and its terminology.

(2) Warning responsibility for the general public is fundamentally vested in local offices. If a severe local storm is in progress or its existence is suspected, the local station should issue a warning for the threatened areas in its area of county responsibility and ensure that adjoining Weather Bureau Offices are informed, even if no prior guidance has been received from SELS, or the responsible Weather Bureau Forecast Office with area forecast center responsibilities.

(3) Local offices are authorized to issue all-clears for all or parts of their areas of responsibility when the threat of severe weather has ended.

(4) Severe weather statements will be issued as appropriate, to provide information on developing severe weather, the lack of such developments or severe weather which has occurred or is in existence.

(5) All routine and special surface and upper air observations which are required to carry out their responsibilities in the severe weather program are taken and transmitted.

(6) As appropriate, statements concerning severe local storms which are expected to develop during a period covered by severe weather watches will be included in regularly scheduled local, state and zone forecasts. Forecasts,especially zone forecasts, will be updated as time and workload permit.

d. Flight Advisory Weather Service (FAWS) Units at WBFO's.

(1) In-Flight Advisories for periods up to 4 hours for aircraft (civil and military) and amendments to appropriate aviation forecasts are prepared whenever a severe local storm(s) is expected or is in existence. This can be done even though no prior guidance has been received from SELS, but in such instances SELS will be notified immediately.

(2) The Aviation Severe Weather Watch Bulletins will be reflected as SIGMETS and AIRMETS in the transcribed weather broadcast (TWEB) as soon as possible after its issuance.

2. U. S. Air Force.

The U. S. Air Force through the Military Weather Warning Center (MWWC, the Kansas City centralized forecast facility, Det. 42, 7th Weather Wing) shall provide:

a. Weather warning support in the conterminous United States plus 200 miles off shore to:

(1) U. S. Air Force and U. S. Army installations.

(2) Air National Guard and Air Force Reserve Units.

(3) Plant sites and facilities operated under DOD contracts.

(4) Airborne military aircraft.

b. Via the USAF communications system for the 48 conterminous states plus 200 miles off shore:

(1) Military weather warning advisories for general areas in graphic form, four times daily, at 00Z plus every 6 hours, valid for 12 hours.

(2) Point weather warnings in plain language as required when weather is expected to meet warning criteria. These point warnings are issued to approximately 500 military locations in the conterminous United States.

(3) Severe weather summaries of occurrences of severe convective activity.

(4) Further weather outlooks in plain language twice daily for the six-hour period beyond the 00Z and 12Z advisories.

(5) A continuous meteorological watch on the possibilities of severe weather developments as well as on the other weather phenomena for which MWWC has warning responsibility. (See Chapter 3)

3. U. S. Navy.

a. The Navy does not operate a Severe Local Storm Warning Service. Requirements for early warnings of hazardous flying conditions and local

destructive phenomena are met by NSSFC/MWWC products interpreted locally by Naval Weather Service personnel. Full use is made of information displayed on National Facsimile, military, and civil weather circuits.

b. Navy shall provide one full-time Synoptic Weather Radar Network station at NAS Pensacola, Florida.

4. Federal Aviation Administration (FAA) shall provide:

a. Communication services in support of Severe Local Storms operations. (Service A, Area B Service, Center B Service, Service C)

b. Pilot reports (PIREPS) for use in Severe Local Storm Operation Program.

c. FSS and Tower surface observations.

d. Distribution of AIRMETS and SIGMETS by FSS. Some FSS stations are also assisting in the dissemination of severe local storm information to the public.

5. Exchange of Data Between Agencies. There shall be a mutual exchange of relevant data on the part of all concerned agencies which are outlined in Chapter I. Since NSSFC and MWWC are co-located and are the units responsible for preparing severe weather forecasts, data concerning such forecasts will be exchanged between these units.

6. Coordination Channel for Exchange of Data. The coordination channel for exchange of data between NSSFC and MWWC shall be between the Commander, MWWC and the Director, NSSFC. Unresolved differences will be referred to the Emergency Warning Section, WXAP Division, Weather Bureau and Headquarters, AWS.

7. Joint Technique Development Program. At the present time only the Weather Bureau and the Air Weather Service are actively engaged in developing objective severe weather forecasting techniques. These agencies will engage whenever possible in a joint technique development program and exchange any objective techniques developed by either agency.

DEFINITIONS

1. General. One of the aims of this PLAN is to list and define common meteorological terms, subject to multiple interpretations, which are used by the agencies preparing severe local storms forecasts and warnings. This will help users receive maximum benefits through maximum understanding.

2. Definitions. For the purposes of this PLAN, the following definitions will be used:

a. All-Clear Bulletins: Releases distributed by all field offices other than SELS that have made public distribution of a severe weather watch or warning to indicate that the threat has ended in their area of county responsibility. If an all-clear is issued for only part of the affected area in a station's area of county responsibility it will be called an "All-Clear Bulletin for a Limited Area."

b. Area of County Responsibility: The area encompassing all the counties assigned to a specified Weather Bureau Office. This office has responsibility for arranging for the distribution of warnings and other types of weather information in these counties.

c. Aviation Severe Weather Watch Bulletin (WW). The Severe local storm bulletins prepared by SELS to assist Weather Bureau offices and Flight Service Stations (FSSs) in providing service to aviation. These bulletins contain "watches" for tornadoes and or severe thunderstorms, including a designation of the areas where their probability is high during a specified time period.

d. Funnel Cloud: A violent rotating column of air which does not touch the ground, usually pendant from a cumulonimbus cloud.

e. In-Flight Advisories: These advisories fundamentally serve aircraft in flight and deal solely with potentially hazardous weather within a period of two to four hours in advance. The time interval between issuance of advisory and its expiration is generally four hours. There are two types of advisories issued: AIRMET and SIGMET. These advices are distributed on Service A to FAA ARTCC and FSS facilities for serving aircraft in flight and to other WBOs for use as required.

f. Instability Line: A line of incipient, active or dissipating non-frontal instability conditions. It is transitory in character, usually developing to maximum intensity within a period of 12 hours or less and then dissipating in about the same length of time.

g. SELS Synopsis (SELS SYNS): Preliminary discussion of 24-hour (12Z of day of issuance to 12Z next day) severe local storm and other thunderstorm possibilities issued prior to the Severe Weather Outlook Narrative (AC). However, if severe local storm activity is in existence when the SELS SYNS is issued at 0840Z, information on what is expected to happen to this activity prior to 1200Z will be included in the SELS SYNS.

h. SELS Unit or SELS: Designations for the unit charged with the responsibility for forecasting severe local storms for the general public. SELS (generally used title) is a part of the National Severe Storms Forecasting Center (NSSFC), located at Kansas City, Missouri.

i. Severe Local Storms: Dangerous storms that usually cover relatively small geographical areas and periods of time and are of sufficient intensity to threaten life or property. Examples are tornadoes or thunderstorms accompanied by frequent lightning, large hail, and/or damaging winds.

j. Severe Local Storm Observing Network: A reporting system consisting of mobile groups and/or strategically located, non-paid observers who report promptly the occurrence or sighting of severe local storms. These reports are used as a basis for issuing public warnings.

k. Severe Thunderstorm: A severe thunderstorm is defined by wind gusts of 50 knots or greater and/or hail (surface or aloft) 3/4" diameter or larger.

l. Severe Weather Bulletins: The designation given to certain types of severe weather releases and includes the issuance and cancellation of both types of public severe weather watches, warnings, all-clears and aviation severe weather watches. The term "bulletin" is used in the heading as a signal for high priority traffic assuring prompt attention by news media and other users.

m. Severe Weather Outlook Narrative (AC): Written summaries by SELS containing technical information about the possibility and areas of future severe local storm and other thunderstorm development up to 24 hours in advance starting at 1200Z. They are issued for the information of all offices; so forecast offices can mention the possibility of severe local storm development in the morning forecasts if it is deemed advisable; also to assist all offices with their preliminary planning for additional staffing, etc., in the event that a public severe weather watch or warning is issued later in the day.

n. Severe Weather Outlook Graphic: A graphic depiction of the AC transmitted from SELS on the National Facsimile Network near 1200Z. showing the most likely areas of severe and other thunderstorm activity for the 24-hour period following 1200Z. This depiction is a two panel package divided into two 12 hour periods - 1200-0000Z and 0000-1200Z.

o. Severe Weather Statements: Public releases issued by all Weather Bureau offices as appropriate, to provide information on developing severe

weather, the lack of such developments or severe weather which has occurred or is in existence. Statements will not be numbered. Distances in all public releases will be expressed in statute miles.

p. Squall Line: A line of active thunderstorms or squalls which may extend over several hundred miles. It is the phenomenon of the mature or active stage of "instability line" development and may be either a solid or broken line of numerous thunderstorms.

q. Thunderstorm: A local storm produced by a cumulonimbus cloud, and always accompanied by lightning and thunder, usually with strong gusts of wind, heavy rain, and sometimes with hail. Duration seldom exceeds two hours for any one storm.

r. Time of Releases: Local 12-hour standard time will be used in all releases to the public except Aviation Severe Weather Watch Bulletins which will be given in Greenwich Mean Time (GMT). Daylight Saving Time is used when it is in effect. All military releases are given in GMT. Date of the day just beginning should be used when a release is made at midnight.

s. Tornado: A violent rotating column of air forming a pendant, usually from a cumulonimbus cloud and touching the ground. It nearly always starts as a funnel cloud and is accompanied by a loud roaring noise. On a local scale, it is the most destructive of all atmospheric phenomena.

t. Tornado (Severe Thunderstorm) Warning Bulletin: Releases issued by local offices to warn the public of the approach of a tornado or a severe thunderstorm already in existence or suspected to be in existence.

u. Tornado (Severe Thunderstorm) Watch Bulletin. The severe local storm bulletins prepared for the public. The bulletins contain "watches" for tornadoes and/or severe thunderstorms, including a designation of the areas where their probability is high during a specified time period.

v. Waterspout: When a funnel cloud forms over a body of water such as a bay, lake or gulf and touches the water it is called a waterspout.

CHAPTER 3

FORECASTS AND WARNINGS

1. General. Although every effort was made to standardize terminology, adopt common definitions and adjust criteria to a common base, it was recognized that each agency had differing operational warning criteria that had to be met. Therefore, standardization will be used wherever possible in forecasts and warnings, but each agency retains the right to specify the forecast and warning criteria which are needed to carry out the missions of their services. The common criteria and differences will be discussed in the following sections.

2. Severe Local Storms. In order to qualify as a Severe Local Storm at least one of the following conditions must be present:

a. Tornado.

b. Funnel Cloud.

c. Severe Thunderstorms, i.e. either or:

(1) Surface winds with gusts equal to or greater than 50 knots.

(2) Hail of 3/4 inch or greater in diameter, aloft or at the surface.

d. Waterspouts.

3. Other Warning Criteria. All other phenomena described in the various warnings, bulletins and advisories should be categorized as "other warning criteria", and not called severe weather phenomena. Such other warning criteria will be listed separately in appropriate ESSA/Weather Bureau and USAF/Air Weather Service publications.

4. Thunderstorm Intensity Categories. Only the following thunderstorm intensity classes will be used in the forecasting and warning functions of the agencies listed in Chapter I.

a. Thunderstorm: Wind gusts less than 50 knots and hail, if any, less than 3/4 inch in diameter.

b. Severe Thunderstorm: Wind gusts of 50 knots or greater and/or hail 3/4 inch or greater in diameter aloft or at the surface.

5. Thunderstorm Density Categories. The following adjectives will be used to describe the expected density of severe thunderstorms along an instability line, or in an area.

a. Isolated - an extremely small number are expected.

b. Few - up to 15% coverage.

c. Scattered - 16 to 45% coverage.

d. Numerous - more than 45% coverage.

Adjectives such as the above will not be used to indicate the expected density of tornadoes. The tornado watch bulletin will simply state that the threat of tornadoes exists in the designated watch area.

6. ESSA Weather Bureau Severe Local Storm Warning Service.

a. Criteria for Severe Weather Watch Bulletins. This section discusses the criteria which must be equaled or exceeded before severe weather watch bulletins are issued by SELS. The criteria for aviation and public severe watch bulletins are different, with Aviation Severe Weather Watch Bulletins having the lower criteria. Therefore, whenever a public watch is issued, an aviation watch is also issued. Any or all of the categories listed may be mentioned in the following issuances to indicate more fully the severe weather expected.

b. Aviation and Public Severe Weather Watch Bulletin Issued Simultaneously.

(1) Severe Thunderstorm: One or more of the following:

(a) Damaging wind - sustained or gusty surface winds greater than 65 knots (75 mph).

(b) Hail, surface of 3/4" diameter or larger.

(2) Tornado:

(a) Severe weather watches that mention expected tornadoes, also imply that thunderstorm activity, usually severe, is expected. Funnel clouds will not be forecast in either an Aviation Severe Weather Watch Bulletin or a Public Severe Weather Watch Bulletin.

(b) Distances from reference points in public forecasts will be expressed in statute miles.

c. Aviation Severe Weather Watch Bulletin Only.

(1) Severe Thunderstorm: One or more of the following:

(a) Sustained or gusty surface winds of 50 through 65 knots (58 to 75 mph).

(b) Hail, aloft of 3/4" diameter or larger. The word hail in a bulletin implies to the surface as well as aloft unless qualifying phrases such as "hail aloft" are used.

(c) Distances from reference points in aviation forecasts will be expressed in nautical miles. The Weather Bureau will call this to the attention of all FAA Flight Service Stations which are acting as distributers of watch information to the public, so that this information will be distributed to the public in statute miles. The nautical mile term will be converted to the nearest even five statute miles before it is released to the public to agree with the distances used in the public watches.

d. Examples of Public Severe Weather Watch Bulletins.

(1) ALSYM A MKCC 022205Z

TORNADO WATCH BULLETIN NUMBER 23
ISSUED 4 PM CST MARCH 2 1967

THE WEATHER BUREAU HAS ISSUED A TORNADO WATCH FOR...
PORTIONS OF EASTERN LOUISIANA
A PORTION OF WEST CENTRAL ALABAMA AND
MOST OF MISSISSIPPI

THE THREAT OF TORNADOES WILL EXIST IN THESE AREAS FROM
5 PM UNTIL 11 PM CST THIS THURSDAY EVENING. SCATTERED
SEVERE THUNDERSTORMS WITH LARGE HAIL AND LOCALLY
DAMAGING WINDS ARE ALSO FORECAST.

THE GREATEST THREAT OF TORNADOES AND SEVERE
THUNDERSTORMS IS IN AN AREA ALONG AND 70 MILES
EITHER SIDE OF A LINE FROM BATON ROUGE LOUISIANA
TO TUPELO MISSISSIPPI.

PERSONS IN OR CLOSE TO THE TORNADO WATCH AREA ARE
ADVISED TO BE ON THE WATCH FOR LOCAL WEATHER DEVELOPMENTS
AND FOR LATER WEATHER STATEMENTS AND WARNINGS.

(2) ALSYM A MKCC 022150Z

SEVERE THUNDERSTORM WATCH BULLETIN NUMBER 24
ISSUED 3:40 PM CST MARCH 2 1967

THE WEATHER BUREAU HAS ISSUED A SEVERE THUNDERSTORM WATCH FOR...
PORTIONS OF CENTRAL OKLAHOMA AND
A PORTION OF SOUTH CENTRAL KANSAS

THE THREAT OF ONE OR TWO ISOLATED SEVERE THUNDERSTORMS WITH
LARGE HAIL AND DAMAGING WINDS WILL EXIST IN THESE AREAS
FROM 6:00 PM UNTIL MIDNIGHT CST THIS THURSDAY EVENING.

THE GREATEST THREAT OF SEVERE THUNDERSTORMS IS IN AN AREA
ALONG AND 70 MILES EITHER SIDE OF A LINE FROM 40 MILES EAST
OF WICHITA KANSAS TO 20 MILES SOUTH OF ARDMORE OKLAHOMA.

PERSONS IN OR CLOSE TO THE SEVERE THUNDERSTORM WATCH AREA
ARE ADVISED TO BE ON THE WATCH FOR LOCAL WEATHER DEVELOPMENTS
AND FOR LATER STATEMENTS AND WARNINGS.

e. Example of Tornado Watch Cancellation Bulletin.

ALSYM A MKCC 102242Z

TORNADO WATCH CANCELLATION BULLETIN NUMBER 100
ISSUED 5:40 PM CDT JUNE 10 1967

THE WEATHER BUREAU HAS CANCELLED TORNADO WATCH NUMBER 99
ISSUED AT 2:00 PM CDT THIS SATURDAY AFTERNOON FOR...
PORTIONS OF EASTERN LOUISIANA
A PORTION OF WEST CENTRAL ALABMA AND
MOST OF MISSISSIPPI.

TORNADOES ARE NOT EXPECTED TO DEVELOP AS EXPECTED IN
THESE AREAS AND PERSONS IN OR CLOSE TO THE PREVIOUSLY
DESIGNATED AREAS CAN RESUME THEIR NORMAL ACTIVITIES.

f. Example of Aviation Severe Weather Watch Bulletin(WW).

ALSYM A MKCC 071803Z

WW MKCC 071803Z

MKC 071800Z

AVIATION SEVERE WEATHER WATCH BULLETIN NUMBER 342

AREA ONE...TORNADO WATCH VALID 2000Z TO 0200Z

A. ALG AND 60 NM EITHER SIDE OF A LINE FM CHILDRESS TEX
TO TULSA OKLA. PUB WATCH ISSUED.

B. TORNADOES AND SCTD SVR TSTMS WITH HAIL SFC AND ALF TO 1 IN.
EXTRM TURBC AND SFC WND GUSTS TO 65 KTS. NMRS CBS WITH MAX
TOPS 450.

C. INSTBY LINE DVLPG 1900Z TO 2000Z VCNTY DODGE CITY KAN
CHILDRESS TEX 30 MIS E MIDLAND TEX SWWD MOVG EWD 20 TO
25 KTS.

AREA TWO...SVR TSTM WATCH VALID 2100Z TO 0300Z

A. ALG AND 50 NM EITHER SIDE OF A LINE
FM 60 NM MIS E MIDLAND TEX TO DALLAS TEX. PUB WATCH ISSUED.

B. A FEW SVR TSTMS WITH HAIL 3/4 TO 1 IN DIAM. EXTRM TURBC MAX AND SFC WND GUSTS TO 60 KTS ISOLD 70 KTS. SCTD CBS WITH MAX TOPS TO 400.

C. SAME AS C IN AREA 1 ABV.

AREA THREE...SVR TSTM WATCH VALID 1900Z TO 2400Z

A. ALG AND 50 NM...EITHER SIDE OF A LINE
FM COLUMBIA S.C. TO BLACKSTONE VA.

B. ISOLD SVR TSTMS WITH HAIL SFC AND ALF TO 3/4 IN. EXTRM TURBC AND SFC WND GUSTS TO 50 KTS. A FEW CBS WITH MAX TOPS TO 400.

C. TSTMS DVLPG ALG APLCNS ERY AFTN MOVG AWAY FM MTNS AND FRMG SQLN OR SERIES SHORT SQLNS MOVG EWD AND SEWD ABT 30 KTS.

D. OTR TSTMS

TSTMS WITH INSTBY LINE FM SW KANS WRN OKLA INTO W TEX N OF WARM FRONT PRODUCING 1/4 TO 1/2 IN HAIL AND ISOLD SVR TURBC ACRS EXTRM SRN KANS INTO W CNTRL MO FM 2000Z TIL 0600Z. WIDESPREAD CNVTV TSTM ACTVTY DVLPG ARND 1800Z TO 1900Z FM CNTRL LA ACRS SRN MISS SRN ALA NRN FLA NWD THRU GA CAROLINAS MD AND DEL. THESE TSTMS MORE ACTV AND NMRS FM CNTRL ALA INTO ERN GA.

E. MEAN WIND VECTOR 24550.

g. Example of Aviation Severe Weather Watch Cancellation Bulletin.

ALSYM A MKCC 261730Z

WW MKCC 261730Z

MKC 261725Z

AVIATION SEVERE WEATHER WATCH CANCELLATION
BULLETIN NUMBER 381

THE WEATHER BUREAU HAS CANCELLED AVIATION SEVERE THUNDERSTORM WATCH NUMBER 380 ISSUED AT 1500Z MAY 26 1967.

7. Functions of Radar Analysis and Development Unit (RADU).

An important adjunct of NSSFC is the Radar Analysis and Development Unit. The radar facsimile chart and the hourly radar summary (SD-1) transmitted on Service A circuits, are prepared by this Unit.

The manual plotting of the RAREPS sent at H+45 from stations in the Synoptic Weather Radar Network requires from ten minutes to occasionally 40 minutes, depending upon the number of echoes reported. In order to meet communications deadlines, the radar summary chart must be ready for transmission by 30 minutes past the hour. Therefore, an arbitrary deadline for completion the plotting has been set at 15 minutes past the hour in order to provide time for the preparation of the radar summary fax chart and the SD-1. This means that at times it is necessary to omit some reports, in which case the areas of minimum significance are omitted and this fact is indicated in the summary and/or facsimile chart.

When the manual plotting is completed the radar summary chart and SD-1 are prepared. The Interdepartmental Conference agreed that the geographical areas used in the SD-1 will be those shown in Figure 1. Reference points used in these summaries will only be those shown in Figure 2.

Radar data from Palmdale, Salt Lake City and Albuquerque are in alpha-numeric form, grouped in broad geographical areas and are appended to the hourly SD-1 prepared by RADU. The SD-1 prepared by RADU is generally for the area east of the Continental Divide.

The facsimile (ADUS) chart provides a much more detailed and accurate picture of the radar patterns. Echoes can be traced in detail on the facsimile chart while they must, in the interest of brevity, be grouped together into larger areas for the SD-1. At the present time 16 charts are transmitted, five of which are half-charts. The half-chart transmissions are oriented to take in the areas of most activity and severe storm forecast boxes. Scale of the radar summary charts is 1:13 M.

8. Severe Weather Warnings.

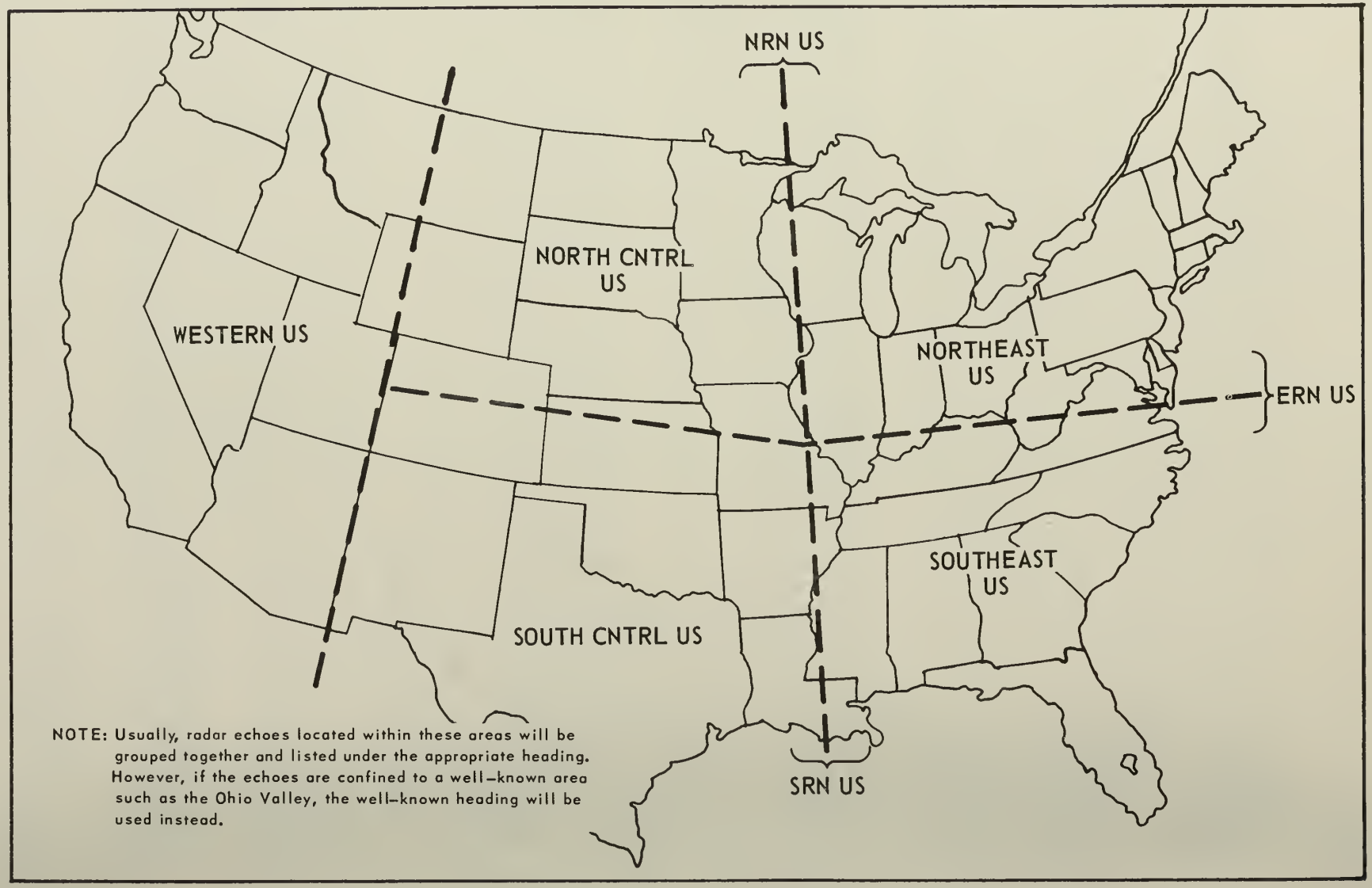
Severe weather warnings will be issued immedately by the appropriate Weather Bureau Office when reports of actual or suspected severe weather in or near a station's area of responsibility indicate an imminent threat. In those cases where a warning is issued without prior guidance from SELS the station will notify SELS immediately of the action taken, using RAWARC where available.

a. Types of Warnings. Each warning will be identified as a SEVERE THUNDERSTORM WARNING BULLETIN or TORNADO WARNING BULLETIN. It will mention the most severe type of weather expected at the surface and will identify the Weather Bureau Office originating the warning and the date and time of release.

b. Time Interval. Time interval for a warning is usually for and seldom exceeds one hour. Valid time of the warning is specified in the warning bulletin. The warning is updated or an all-clear issued as appropriate at the end of the hour.

FIGURE 1

GEOGRAPHICAL AREAS USED IN SD-1 HOURLY RADAR SUMMARIES



NOTE: Usually, radar echoes located within these areas will be grouped together and listed under the appropriate heading. However, if the echoes are confined to a well-known area such as the Ohio Valley, the well-known heading will be used instead.

FIGURE 2. STANDARD REFERENCE POINTS FOR SD-1 SUMMARIES

SCALE OF NAUTICAL MILES AT VARIOUS LATITUDES
SCALE 1:7,500,000
POLAR STEREOGRAPHIC PROJECTION TRUE AT LATITUDE 60
CHART 7990
CHART 7990 OCT. 1968

c. Criteria for Severe Thunderstorm Warning. In general for warning purposes, a severe thunderstorm is one that is reported to have or suspected of having localized surface wind gusts equal to or greater than 58 mph (50 knots) and/or surface hail 3/4" diameter or larger.

(1) Information on thunderstorms reported to have or suspected of having winds of less than 58 mph (50 knots),and/or hail less than 3/4" diameter are disseminated to the public by means of severe weather statements.

d. Radar Data as a Basis for Warnings. Full advantage should be taken of local radar observations, in addition to those received by teleprinter or by telephone, in issuing tornado and severe thunderstorm warnings. When radar evidence is sufficient, in the judgment of the responsible official, to identify a dangerous storm, warnings based on these data should be issued immediately. Ground reports from the threatened area should then be secured, by telephone calls or through police radio, to assist in issuing follow-up releases.

e. Examples of Severe Weather Warnings.

(1) SEVERE THUNDERSTORM WARNING BULLETIN
EANS REQUESTED
WEATHER BUREAU WICHITA KANSAS
ISSUED 4:40 PM CDT MAY 10 1967

A SEVERE THUNDERSTORM WARNING IS IN EFFECT UNTIL 5:30 PM FOR PERSONS IN BUTLER COWLEY ELK AND GREENWOOD COUNTIES.

A LINE OF THUNDERSTORMS WAS INDICATED BY RADAR FROM WELLINGTON TO AUGUSTA AT 4:35 PM. CDT. THE LINE OF THUNDERSTORMS IS MOVING TOWARD THE NORTHEAST AT 20 MPH. AT 4:35 PM WELLINGTON REPORTED 70 MPH WINDS AND 1 INCH HAIL.

BE PREPARED TO MOVE TO A PLACE OF SAFETY IF THREATENING CONDITIONS ARE SIGHTED. TO REPORT LARGE HAIL OR DAMAGING WINDS...PLACE AN EMERGENCY COLLECT CALL TO THE WICHITA KANSAS WEATHER BUREAU (ON WH 3-3901)* OR ASK THE NEAREST LAW ENFORCEMENT AGENCY TO RELAY YOUR REPORT TO THE WEATHER BUREAU.

(2) TORNADO WARNING BULLETIN
EANS REQUESTED
WEATHER BUREAU OKLAHOMA CITY OKLAHOMA
ISSUED 4:00 PM CDT APRIL 30 1967

A TORNADO WARNING IS IN EFFECT UNTIL 5:00 PM FOR PERSONS IN COTTON AND COMANCHE COUNTIES.

A TORNADO WAS REPORTED BY THE PUBLIC 7 MILES EAST OF GRANDFIELD OKLAHOMA AT 3:55 PM. CDT. THIS TORNADO IS MOVING TOWARD THE NORTHEAST AT 30 MPH.

IF A TORNADO OR THREATENING CONDITIONS ARE SIGHTED...BE PREPARED TO MOVE TO A PLACE OF SAFETY. TO REPORT A TORNADO OR OTHER SEVERE WEATHER...PLACE AN EMERGENCY COLLECT CALL TO THE OKLAHOMA CITY WEATHER BUREAU (on MUTUAL 5-6350)* OR ASK THE NEAREST LAW ENFORCEMENT AGENCY TO RELAY YOUR REPORT TO THE WEATHER BUREAU.

*Optional

9. FAWS Unit's Responsibilities.

a. Issue IN-FLIGHT ADVISORIES.

(1) Criteria for issuance of AIRMET.

(a) Moderate icing;

(b) Moderate turbulence over an extensive area;

(c) Extensive areas of visibilities less than two miles and/or ceilings less than 1000 feet, including mountain ridges and passes; and

(d) Winds of 40 knots or more within 2000 feet of the surface.

(2) Criteria for issuance of SIGMET.

(a) Tornadoes;

(b) Lines of thunderstorms (squall lines);

(c) Embedded thunderstorms;

(d) Hail 3/4" or more surface or aloft;

(e) Severe and extreme turbulence;

(f) Heavy icing; and

(g) Widespread duststorms/sandstorms lowering visibilities to less than two miles.

b. Advise ARTCC's of any SIGMETS that it issues which affect their respective ARTCC areas.

c. Include appropriate reference to expected severe weather in IN-FLIGHT ADVISORIES and in scheduled and amended aviation forecasts, PATWAS and TWEB broadcast scripts.

10. USAF Warning Procedures.

a. General: The Kansas City MWWC provides, via the USAF communications system warnings for:

(1) Tornadoes

(2) Thunderstorms

(3) Strong surface winds

(4) Heavy rain or snow

(5) Freezing precipitation

(6) Severe blowing dust, sand or snow

(7) Funnel clouds

(8) Waterspouts

b. Military Weather Warning Advisories. The MWWC issues graphic weather warning advisories (Figures 3 and 4) four times daily at 0000Z and plus every six hours. Each advisory shows the areas where any of the weather elements listed above are expected to exist in the following 12-hour period. An advisory is an estimate of the weather producing potential of the existing synoptic pattern and air masses, based on the assumption that subsequent changes in these features occur as forecast.

(1) Purpose and Use. The graphic warning advisories are designed to provide basic guidance to both the field forecaster and to the point warning forecasters at the MWWC. They are issued at fixed times; preparation time is limited by data availability and presentation format. Advisories may contain fairly large areas as in the case of thunderstorms, snow, strong gradient winds, etc., but the areas of more severe weather such as tornadoes and severe thunderstorms are usually more limited in time and space. Field forecasters should use the graphic advisories:

(a) To alert themselves and users to potential areas of significant weather.

(b) As ready made briefing aids.

(c) To indicate the probability of their stations being directly affected during the advisory period.

(2) Amendment. Advisories are amended when elements described change, or are expected to change, one category or more (e.g., non-severe thunderstorm expected to become severe thunderstorm), and when area boundaries change, or are expected to change, by 60 miles or more.

FIGURE 3. EXAMPLE OF DESCRIPTIVE PORTION OF A MILITARY WEATHER WARNING ADVISORY

KSWC
WWXX WWXX WWXX KSWC 061200Z
MILITARY WEATHER WARNING ADVISORY NR 23 VALID 061800Z TO 070600Z

GRAPHIC BULLETIN

X...RED AND BLACK...TORNADOES AND/OR DAMAGING WINDSTORM-ISOLATED... THUNDERSTORMS SCATTERED-FEW SEVERE WITH 1 1/2 INCH HAIL AND WSW TO NW GUSTS TO 65 KNOTS...MAX THUNDERSTORMS TOPS 500...LOCALLY HEAVY RAIN SHOWERS...2000Z...SURFACE WINDS SSE TO SSW 20 KNOTS GUSTS TO 40 KNOTS ...1800Z TO 0000Z...CURRENT ACTIVITY EXTENDING FROM SW OK INTO CENTRAL NB CONTINUING ENE MOVEMENT. SQUALL LINE EXPECTED TO REFORM AFTERNOON FROM SW NB THROUGH WRN KS INTO SW TX MOVING ENE AT 25 TO 30 KNOTS.

O...RED AND BLACK...TORNADOES AND/OR DAMAGING WINDSTORMS-ISOLATED... THUNDERSTORMS SCATTERED-FEW SEVERE WITH 2 INCH HAIL AND WSW GUSTS TO 65 KNOTS...MAX THUNDERSTORMS TOP 520...LOCALLY HEAVY RAIN SHOWERS... 1900Z TO 0200Z...SURFACE WINDS SSE TO SSW 20 KNOTS GUSTS TO 35 KNOTS ...1800Z TO 0000Z...SEE REMARKS ON PARA X ABOVE.

Z...BLUE AND BLACK...DAMAGING WINDSTORMS-ISOLATED...THUNDERSTORMS SCATTERED-FEW SEVERE WITH 1 TO 1 1/2 INCH HAIL AND WSW TO NW GUSTS TO 65 KNOTS... MAX THUNDERSTORMS TOPS 500...LOCALLY HEAVY RAIN SHOWERS...1900Z TO 0300Z ...SURFACE WINDS SSE TO SSW 20 KNOTS GUSTS TO 35 KNOTS 1800Z TO 0000Z.

A...BLACK...SURFACE WINDS WSW TO NW 20 KNOTS FEW GUSTS TO 35 KNOTS...2000Z TO 0200Z.

S...BLACK...SURFACE WINDS SW TO W 20 KNOTS GUSTS TO 35 KNOTS...1900Z TO 0200Z.

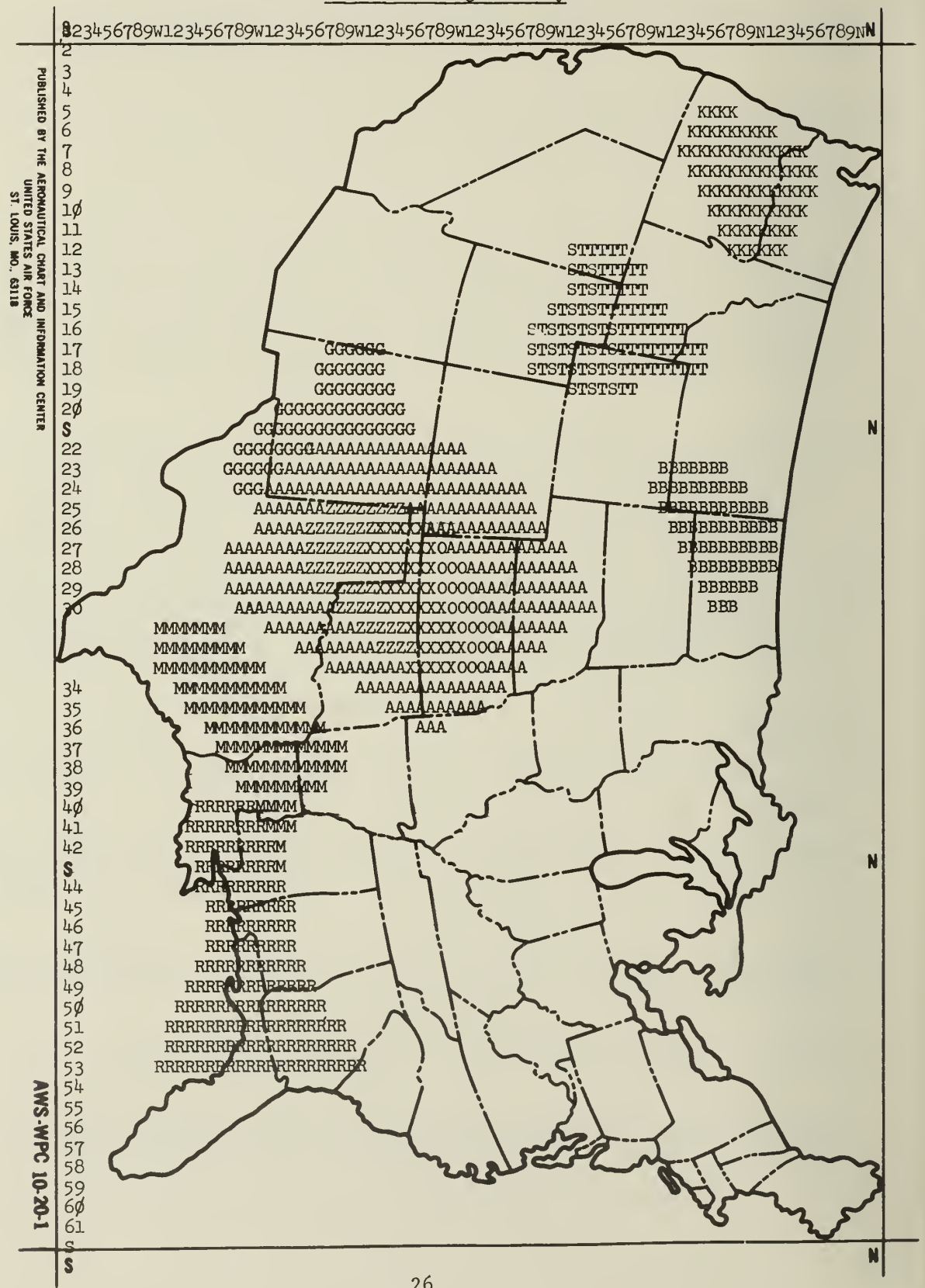
T...ORANGE AND BLACK...THUNDERSTORMS FEW-WITH ISOLATED 1/4 INCH HAIL...MAX THUNDERSTORMS TOPS 300...1800Z TO 0300Z...SURFACE WINDS NW 20 KNOTS FEW GUSTS TO 35 KNOTS...1800Z TO 2300Z.

B...ORANGE AND BLACK...THUNDERSTORMS FEW-WITH ISOLATED 1/4 INCH HAIL...MAX THUNDERSTORMS TOPS 350...1800Z TO 0400Z...SURFACE WINDS SSE TO SSW 20 KNOTS GUSTS TO 40 KNOTS...1800Z TO 0100Z.

G...ORANGE...THUNDERSTORMS ISOLATED...MAX THUNDERSTORMS TOPS 300...2000Z TO 0200Z.

M...ORANGE...THUNDERSTORMS FEW-WITH ISOLATED 1/4 INCH HAIL AND SW GUSTS TO LESS THAN 35 KNOTS...MAX THUNDERSTORMS TOPS 320...1900Z TO 0300Z.

Figure 4 -- Example of Graphic Portion of a Military Weather Warning Advisory



(3) Geographical Interpretation. A clear plastic overlay, containing a scaled outline of the conterminous 48 states, placed on the teletype message containing the graphic advisory will provide geographical orientation.

c. Point Weather Warnings. Point weather warnings are issued in plain language (see Figure 5) for the same phenomena as advisories. While advisories provide general guidance to all military forecasters in terms of large and intermediate scale synoptic developments, point warnings are issued for and to specific locations in the smallest scale of space and time consistent with the availability of data and the state of the art. The locations for which MWWC has warning responsibility are listed in Attachment 2, Volume II, Air Weather Service Manual 55-8. Some of these locations include two, three or four installations in one locality; the total number of installations is well over 500. Approximately 50% of these are Air Force, 45% are Army and 5% are Navy. In addition to active military installations, point warnings are issued for National Guard units, arsenals, ammunition plants and other civilian activities under contract to the Department of Defense.

(1) Purpose and Use. Point warnings are issued for specific locations as the situation warrants in contrast to advisories which are issued at scheduled intervals for fixed valid periods. Point warnings are amended, extended or cancelled as necessary. For the sake of accuracy, the optimum lead time is that just long enough to permit necessary protective action. Point weather warnings:

(a) Provide specific warning to an installation where a forecast unit is not assigned.

(b) Alert a responsible individual at locations with limited forecast service.

(c) Alert and guide the field forecaster who has final responsibility for warning the agency he supports.

(2) Interpretation.

Area Extent. Point warnings are issued when specific phenomena are expected to occur within a 10-mile radius of a specific installation, with the following exceptions:

(a) A point warning for a tornado is issued for a 25-mile radius of the installation. The term "VICINITY" is used to identify this increased area.

(b) A point warning for severe thunderstorms is issued for a 25-mile radius of the installation. The term "VICINITY" is used to identify this area.

(c) A point warning for thunderstorms other than severe is issued for a 50-mile radius of the installation. The term "GENERAL AREA" is used to identify this area.

FIGURE 5. EXAMPLE OF MILITARY POINT WARNING

0 032010Z
WWXX WWXX WWXX 3 KSWC 5-6 032010Z
TX 18-19

SEVERE THUNDERSTORMS WITH 1/4 INCH HAIL AND SW GUSTS TO 65 KNOTS VALID 032200Z TO 040200Z TORNADO VICINITY 032200Z TO 040100Z.

OK 7-8

FEW THUNDERSTORMS WITH NO HAIL AND SW GUSTS TO LESS THAN 35 KNOTS EXPECTED IN YOUR GENERAL AREA BETWEEN 031900Z AND 040300Z.

COMMUNICATIONS

1. ESSA Weather Bureau. Collection and Distribution of Severe Local Storms Information.

a. Systems Used.

(1) RAWARC - An acronym for the Weather Bureau's Internal RAREP (Radar Report) and Warning Coordination Teletypewriter System. (See Figure 6 and Annex 1)

(2) EWWS (ESSA Weather Wire Service) - The teletypewriter system, operated by the Weather Bureau which makes around-the-clock weather service available to all mass dissemination media, and other selected users. (See Figure 7 and Annex 2)

(3) NAWAS - Acronym for the National Warning System, a Civil Defense operated telephone hot-line, which connects Civil Defense Warning Points within each warning area. Usually, one or more Weather Bureau offices within each state has a drop on this system.

(4) EANS (Emergency Action Notification Attention Signal) - When there is an urgent need to inform all concerned of existing dangerous weather conditions, radio and TV stations covering a threatened area should be requested to use the EANS. Use of EANS attracts radio and television listeners' attention to a warning and also makes it possible for anyone with a special receiver, or a special attachment to a conventional radio receiver, to receive the information. The use of EANS for this purpose is at the discretion of the individual radio and TV stations.

b. Distribution of Severe Weather Watch and Warning Bulletins.

(1) Public Watches and Warning Bulletin (Figure 8).

(2) Aviation Watch Bulletin and In Flight Advisory (Figure 9).

2. U. S. Air Force.

a. Within the conterminous United States, Air Force weather radar reports are collected via the USAF Comet IIA system and disseminated via the Comet IIB system. MWWC has a drop on Comet IIB; all reports collected via Comet IIA are relayed by Tinker AFB to MWWC via a 100 word per minute landline circuit, JQGBU 866.

(1) The Comet II system is divided into eight geographic areas with a collecting and disseminating circuit covering each area (Figure 10).

(2) Comet II is used to collect and disseminate radar reports.

FIGURE 6

RAWARC TELETYPEWRITER SYSTEM

FIGURE 7

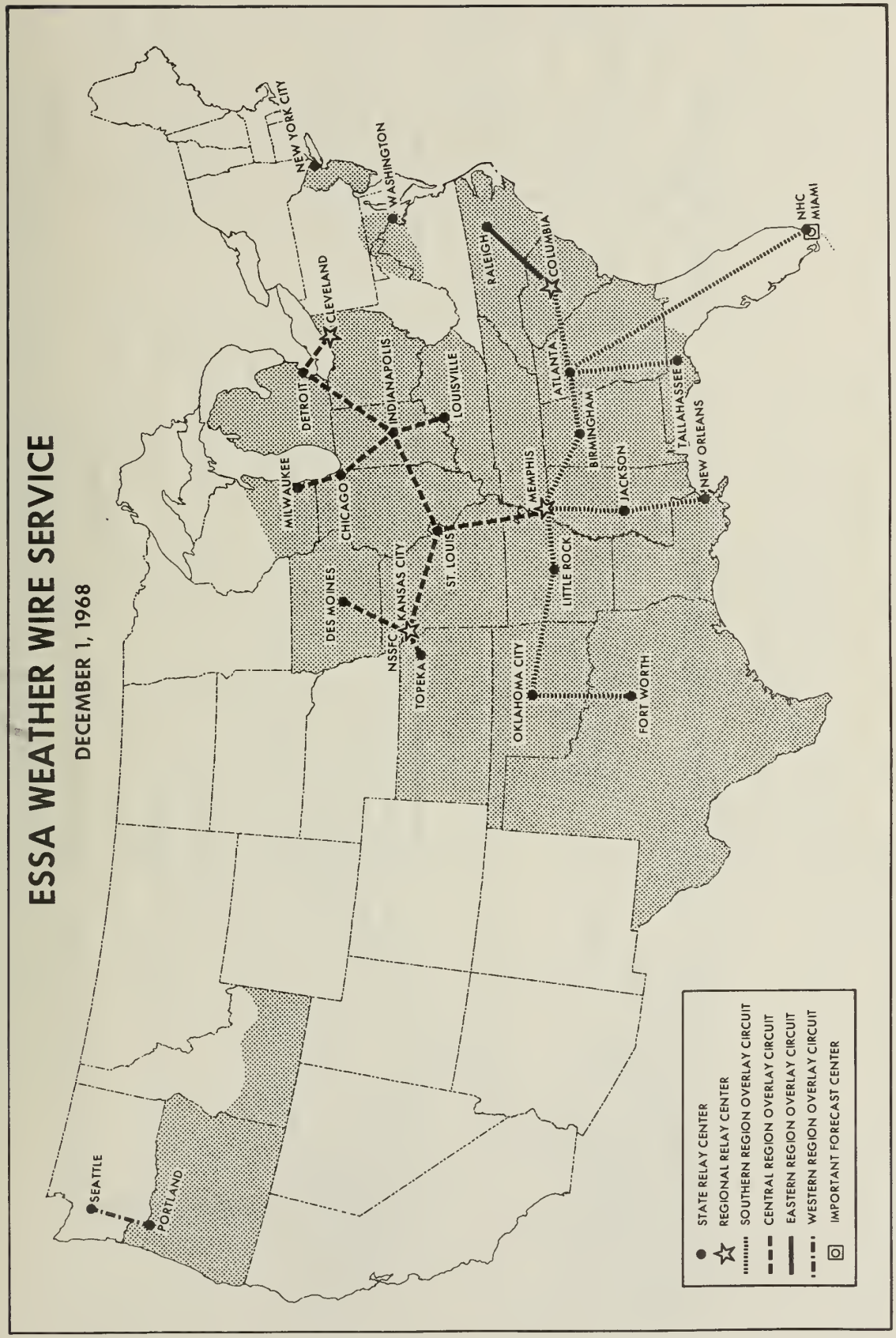

ESSA WEATHER WIRE SERVICE
DECEMBER 1, 1968
SEATTLE
PORTLAND
NEW YORK CITY
WASHINGTON
CLEVELAND
DETROIT
INDIANAPOLIS
LOUISVILLE
MILWAUKEE
CHICAGO
DES MOINES
KANSAS CITY
NSSFC
TOPEKA
ST. LOUIS
MEMPHIS
LITTLE ROCK
OKLAHOMA CITY
FORT WORTH
RALEIGH
COLUMBIA
ATLANTA
BIRMINGHAM
JACKSON
TALLAHASSEE
NEW ORLEANS
NHC
MIAMI
STATE RELAY CENTER
REGIONAL RELAY CENTER
SOUTHERN REGION OVERLAY CIRCUIT
CENTRAL REGION OVERLAY CIRCUIT
EASTERN REGION OVERLAY CIRCUIT
WESTERN REGION OVERLAY CIRCUIT
IMPORTANT FORECAST CENTER

FIGURE 8. DISTRIBUTION OF PUBLIC SEVERE WEATHER WATCH AND WARNING BULLETINS

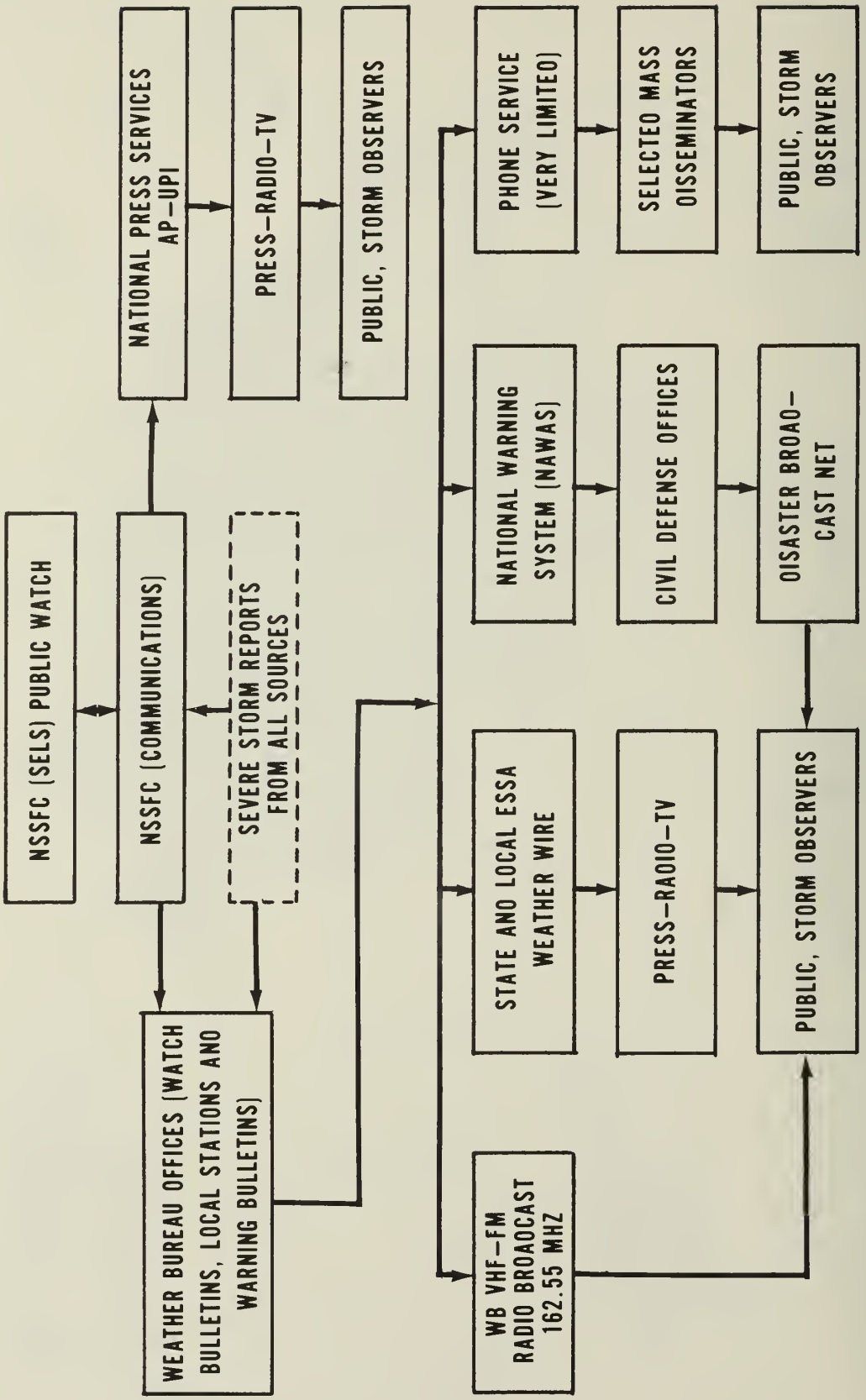


FIGURE 9. DISTRIBUTION OF AVIATION SEVERE WEATHER WATCH BULLETINS-AIRMET AND SIGMET

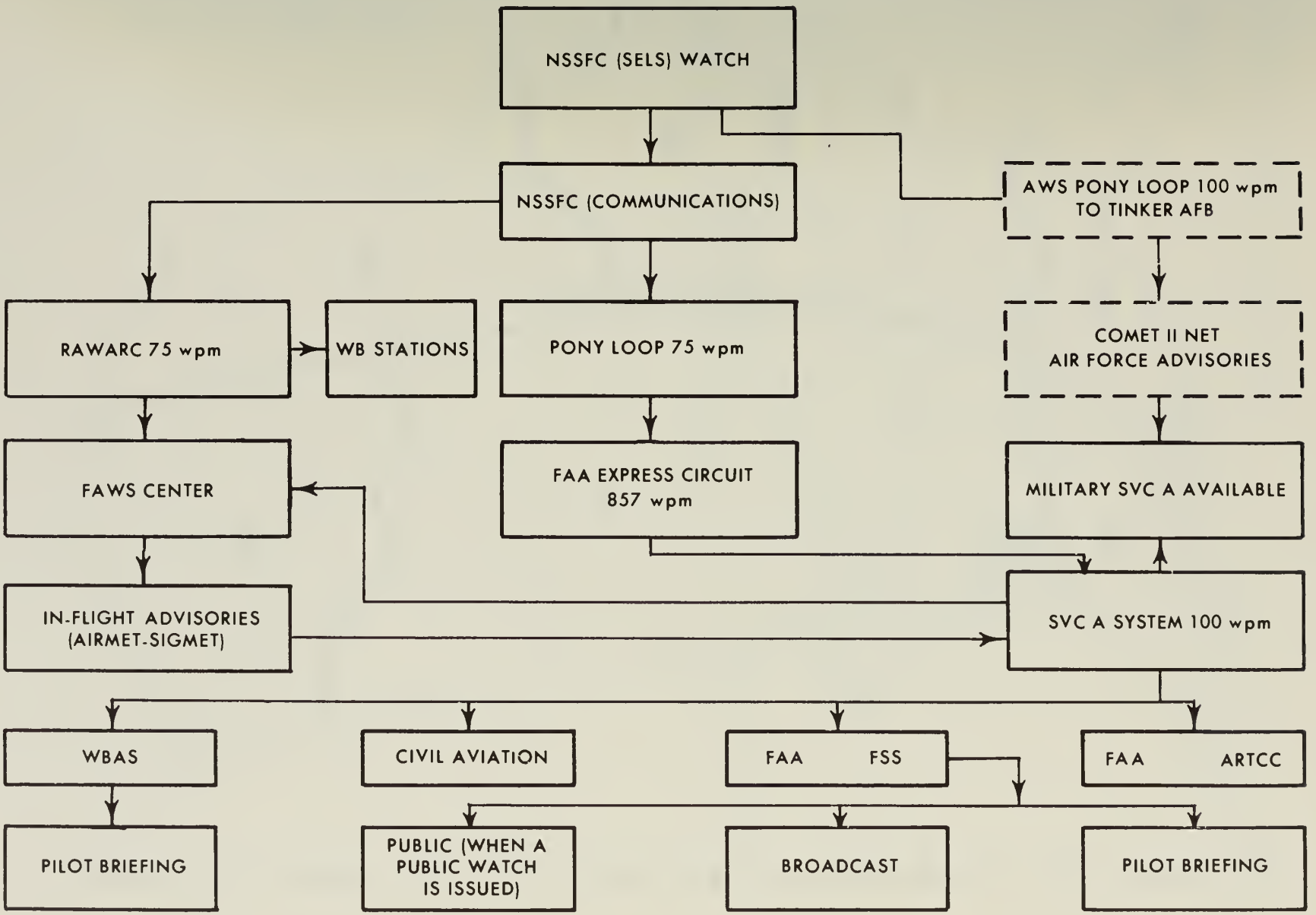
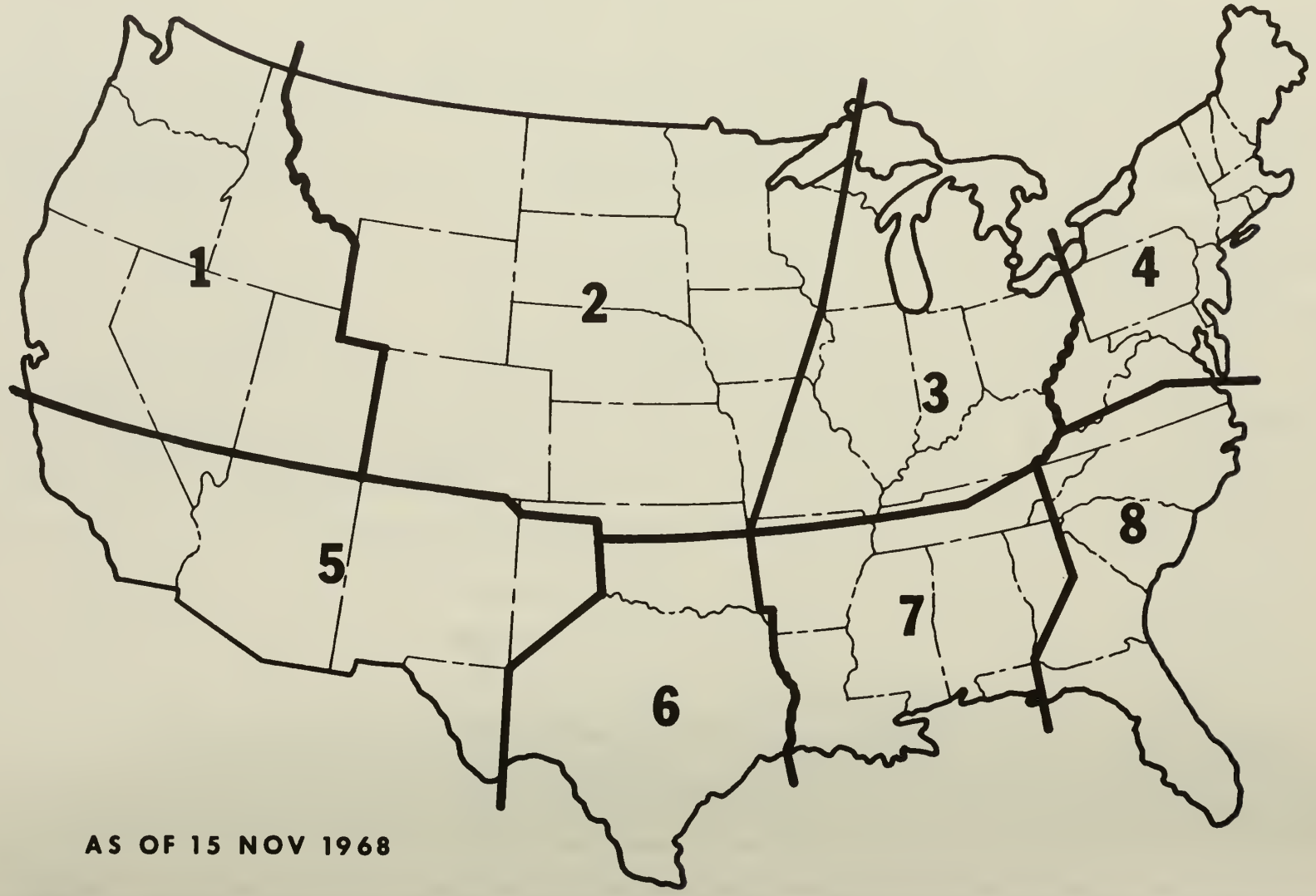


Figure 10. COMET COLLECTING AND DISSEMINATING SYSTEM



3. Federal Aviation Administration.

a. Service A (see Figure 11) will be used for the collection and distribution of Severe Local Storms Information as follows:

(1) Hourly and special airway observations.

(2) Sacramento Radar Report.

(3) Severe Weather Outlook Narrative (AC).

(4) Aviation Severe Weather Watch Bulletins.

(5) AIRMETS and SIGMETS.

(6) Hourly Radar Summary SD-1.

b. Area B Service will be used for distribution of PIREPS from FSS to FAWS offices (see Figure 12).

4. U. S. Navy.

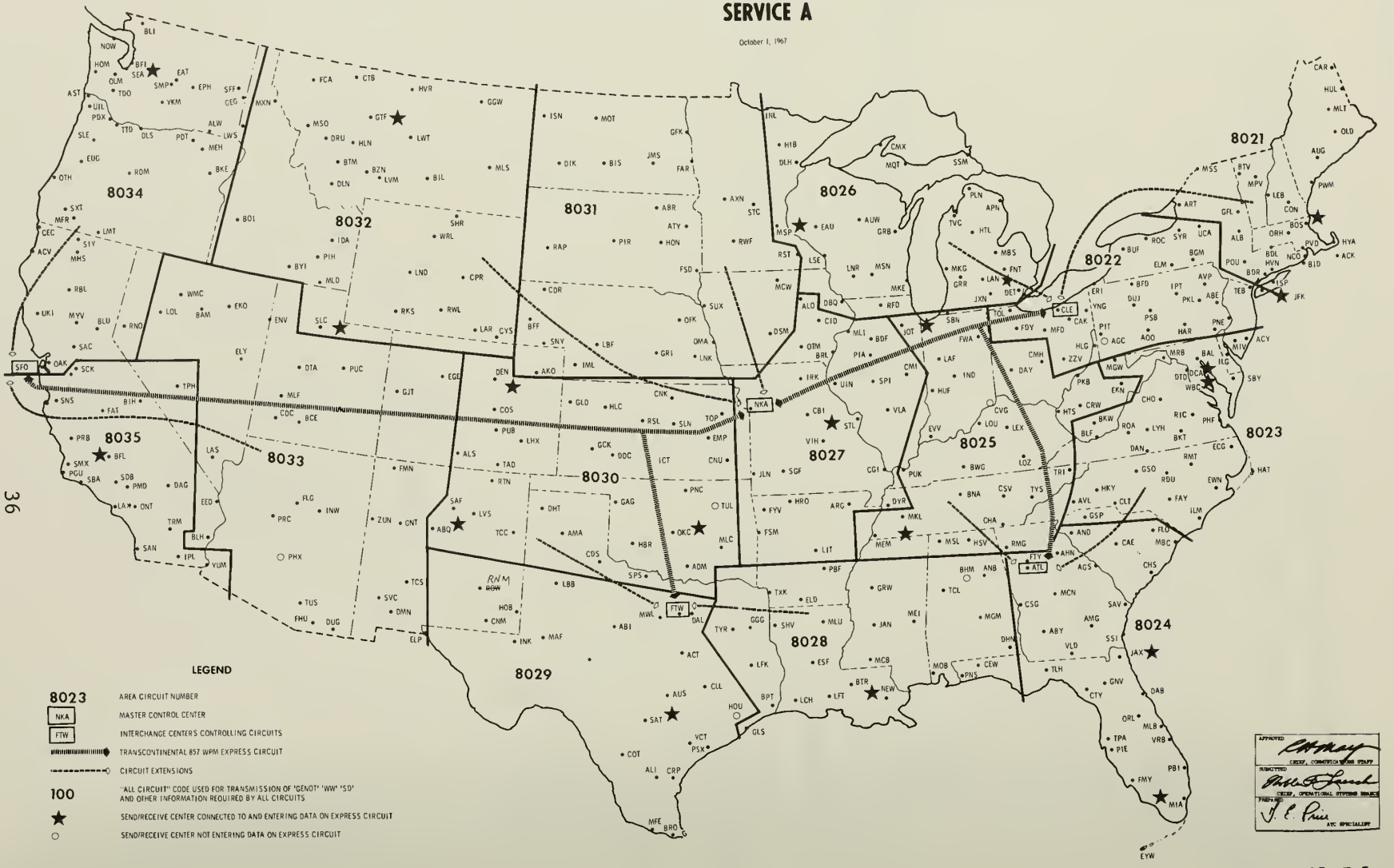
a. Navy weather reports are collected via the USAF Comet IIA system and disseminated via the Comet IIB system.

FIGURE 11

FEDERAL AVIATION ADMINISTRATION

SERVICE A

October 1, 1967



M-14

FIGURE 12

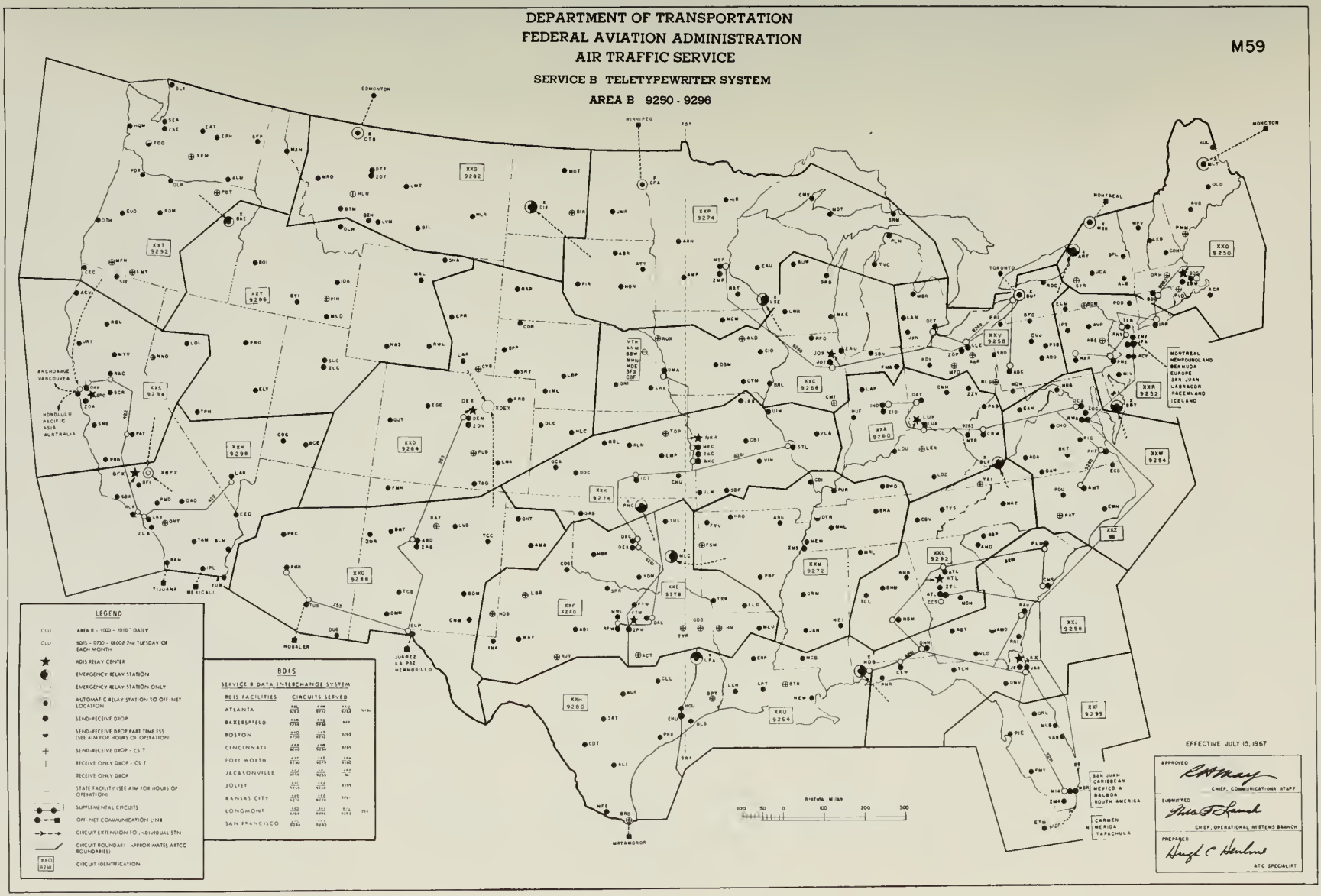
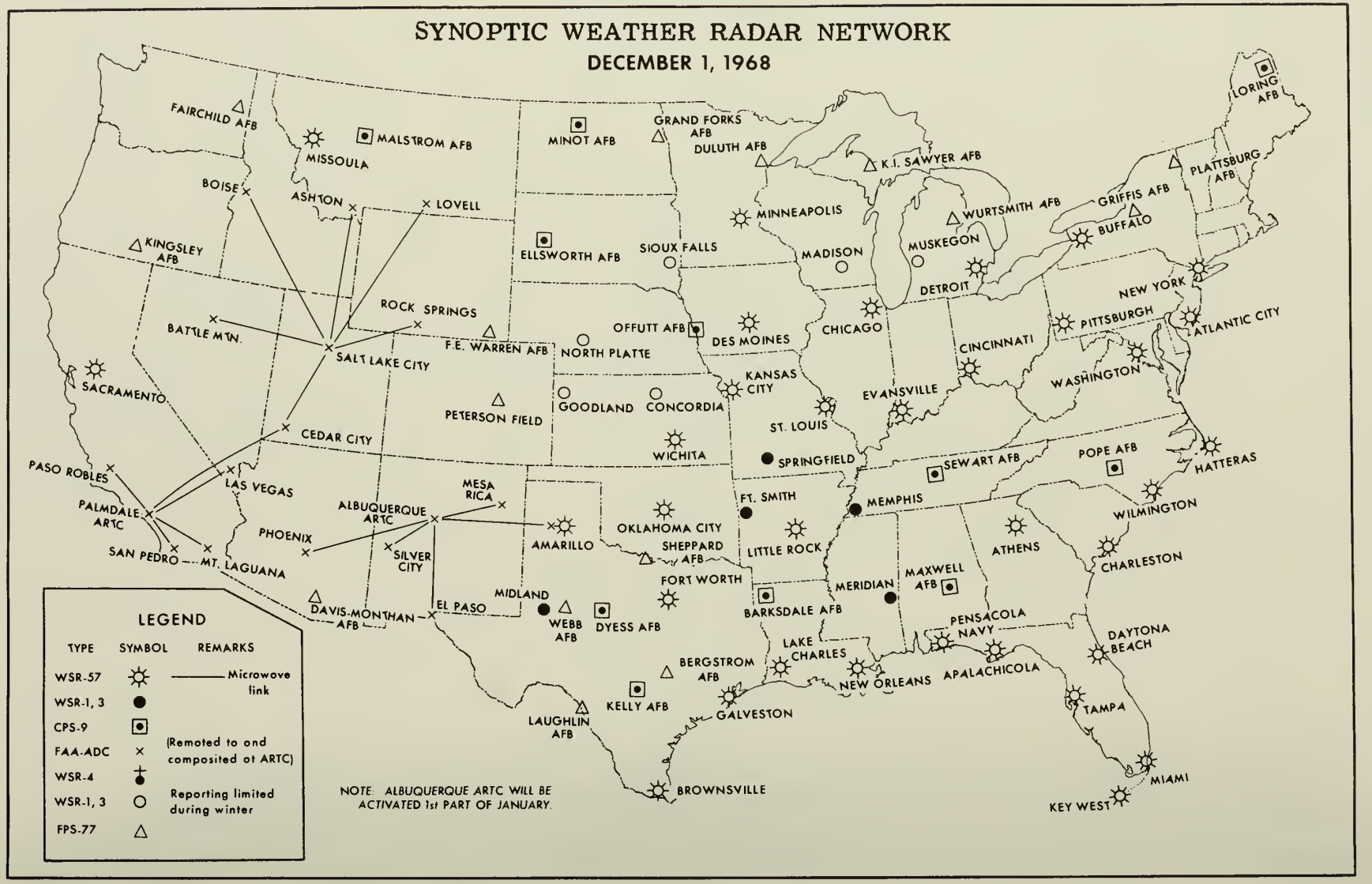

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
AIR TRAFFIC SERVICE
SERVICE B TELETYPEWRITER SYSTEM
AREA B 9250 - 9296
M59
LEGEND
AREA B - 1500 - 1010Z DAILY
1015 - 0730 - 0800Z 2nd TUESDAY OF EACH MONTH
RDIS RELAY CENTER
EMERGENCY RELAY STATION
EMERGENCY RELAY STATION ONLY
AUTOMATIC RELAY STATION TO OFF-NET LOCATION
SEND-RECEIVE DROP
SEND-RECEIVE DROP PART TIME FSS (SEE AIM FOR HOURS OF OPERATION)
SEND-RECEIVE DROP - CS T
RECEIVE ONLY DROP - CS T
RECEIVE ONLY DROP
STATE FACILITY (SEE AIM FOR HOURS OF OPERATION)
SUPPLEMENTAL CIRCUITS
OFF-NET COMMUNICATION LINE
CIRCUIT EXTENSION TO INDIVIDUAL STN
CIRCUIT BOUNDARY (APPROXIMATES ARTCC BOUNDARIES)
CIRCUIT IDENTIFICATION
RDIS
SERVICE B DATA INTERCHANGE SYSTEM
RDIS FACILITIES
CIRCUITS SERVED
ATLANTA
BAKERSFIELD
BOSTON
CINCINNATI
FORT WORTH
JACKSONVILLE
JOLIET
KANSAS CITY
LONGMONT
SAN FRANCISCO
EFFECTIVE JULY 15, 1967
APPROVED
CHIEF, COMMUNICATIONS STAFF
SUBMITTED
CHIEF, OPERATIONAL SYSTEMS BRANCH
PREPARED
ATC SPECIALIST
SAN JUAN CARIBBEAN MEXICO & BALBOA SOUTH AMERICA
CARMEN MERIDA YAPACHULA

FIGURE 13


SYNOPTIC WEATHER RADAR NETWORK
DECEMBER 1, 1968
FAIRCHILD AFB
MALSTROM AFB
MISSOULA
MINOT AFB
GRAND FORKS AFB
DULUTH AFB
K.I. SAWYER AFB
LORING AFB
PLATTSBURG AFB
BOISE
ASHTON
LOVELL
MINNEAPOLIS
WURTSMITH AFB
GRIFFIS AFB
BUFFALO
KINGSLEY AFB
ELLSWORTH AFB
SIOUX FALLS
MADISON
MUSKEGON
DETROIT
NEW YORK
ROCK SPRINGS
BATTLE MTN.
OFFUTT AFB
DES MOINES
CHICAGO
PITTSBURGH
ATLANTIC CITY
F.E. WARREN AFB
NORTH PLATTE
CINCINNATI
SALT LAKE CITY
SACRAMENTO
KANSAS CITY
WASHINGTON
PETERSON FIELD
GOODLAND
CONCORDIA
EVANSVILLE
ST. LOUIS
CEDAR CITY
WICHITA
SPRINGFIELD
SEWART AFB
POPE AFB
HATTERAS
PASO ROBLES
LAS VEGAS
MESA RICA
FT. SMITH
MEMPHIS
WILMINGTON
PALMDALE ARTC
ALBUQUERQUE ARTC
OKLAHOMA CITY
PHOENIX
AMARILLO
SHEPPARD AFB
LITTLE ROCK
ATHENS
CHARLESTON
SAN PEDRO
MT. LAGUANA
SILVER CITY
FORT WORTH
MERIDIAN
MAXWELL AFB
DAVIS-MONTHAN AFB
EL PASO
MIDLAND
WEBB AFB
DYESS AFB
BARKSDALE AFB
PENSACOLA NAVY
DAYTONA BEACH
LAKE CHARLES
BERGSTROM AFB
NEW ORLEANS
APALACHICOLA
KELLY AFB
GALVESTON
TAMPA
LAUGHLIN AFB
MIAMI
BROWNSVILLE
KEY WEST
LEGEND
TYPE
SYMBOL
REMARKS
WSR-57
Microwave link
WSR-1, 3
CPS-9
FAA-ADC
(Remoted to and composited at ARTC)
WSR-4
WSR-1, 3
Reporting limited during winter
FPS-77
NOTE: ALBUQUERQUE ARTC WILL BE ACTIVATED 1st PART OF JANUARY.

OBSERVATIONS

1. Radar Observing and Reporting Plans.

a. General. Radar data which are routinely used in the preparation of NSSFC and MWWC products are available from radars of the Synoptic Weather Radar Network, Figure 13. This network is composed mainly of Weather Bureau WSR-57 radars supplemented by Navy and Air Force weather radars. Selection of radars for the network was made on the basis of attaining the maximum required data with a minimum number of radars. In the western inter-mountain region, air traffic control radars remoted into the Salt Lake City, Palmdale and Albuquerque ARTCC's are used as substitutes for weather dedicated radars.

At these three ARTCC's, Weather Bureau personnel composite the radar data from the radars remoted into these sites and transmit them on RAWARC and an interagency facsimile circuit in the western part of the United States.

(1) Weather Bureau radar observations, other than from these ARTCCs, are transmitted hourly on RAWARC at H+45 in the WBAN RAREP code. More frequent observations are taken in severe weather situations. Data from the ARTCCs are available on RAWARC in the alphanumeric SD-1 format. Observations are taken at 2-hourly intervals, commencing at 1245Z and ending at 0245Z at Salt Lake City and Palmdale. At Albuquerque, observations are taken at 2-hourly intervals commencing at 1645Z and ending at 0245Z. When the temperature is below freezing, reporting is limited during the winter at a number of WSR-3 stations assigned to the network since these radars seldom detect snow.

(2) At approximately the same time (H+45), radar reports from Air Weather Service and Navy radar stations assigned to the Synoptic Weather Radar Network are forwarded to Kansas City from the Air Force communication center at Tinker Field, Oklahoma, via a direct teletypewriter line to MWWC.

(3) The Weather Bureau, Navy and Air Force have other radars which are not a part of the national network. These radars are mainly used for local warning purposes, but on occasion they do enter reports on communication circuits.

b. ADC Radar Sites. There are a number of Air Defense Command (ADC) radar sites capable of detecting and interpreting weather echoes. Annex 3 lists all such sites, together with their associated AWS Air Division (AD) weather stations. Operational commitments permitting, these sites will gladly provide supplementary reports upon request. However, the number of different agencies trying to contact a particular site must be held to a minimum. In general, either the Commander, MWWC or the supervising forecaster of SELS or RADU should attempt to contact a particular site through its associated Air Division weather station.

c. Weather Bureau - Military Radar Reporting Agreement. When radar data from the military stations of the Synoptic Weather Radar Netowk are missing or appear to be in error, the military agencies have authorized the following:

(1) RADU shall call the duty forecaster at the station for the missing data or clarification.

(2) The Air Force and Navy shall provide NSSFC with telephone numbers of stations in the National Weather Radar Reporting Network. Telephone numbers of local use radar stations will also be provided for use in emergency situations.

(3) If FTS or DOD telephone lines are not available commercial telephone shall be used.

d. Local Arrangements for Military Radar Data. If a Weather Bureau station needs radar data from a nearby military radar (network,ADC or local use), such can be obtained by local arrangements between the Weather Bureau Meteorologist in Charge and the Weather Detachment Commander or the commanding officer of the radar facility. Authorizations for such arrangements have been completed between the Weather Bureau and the military agencies in prior agreements.

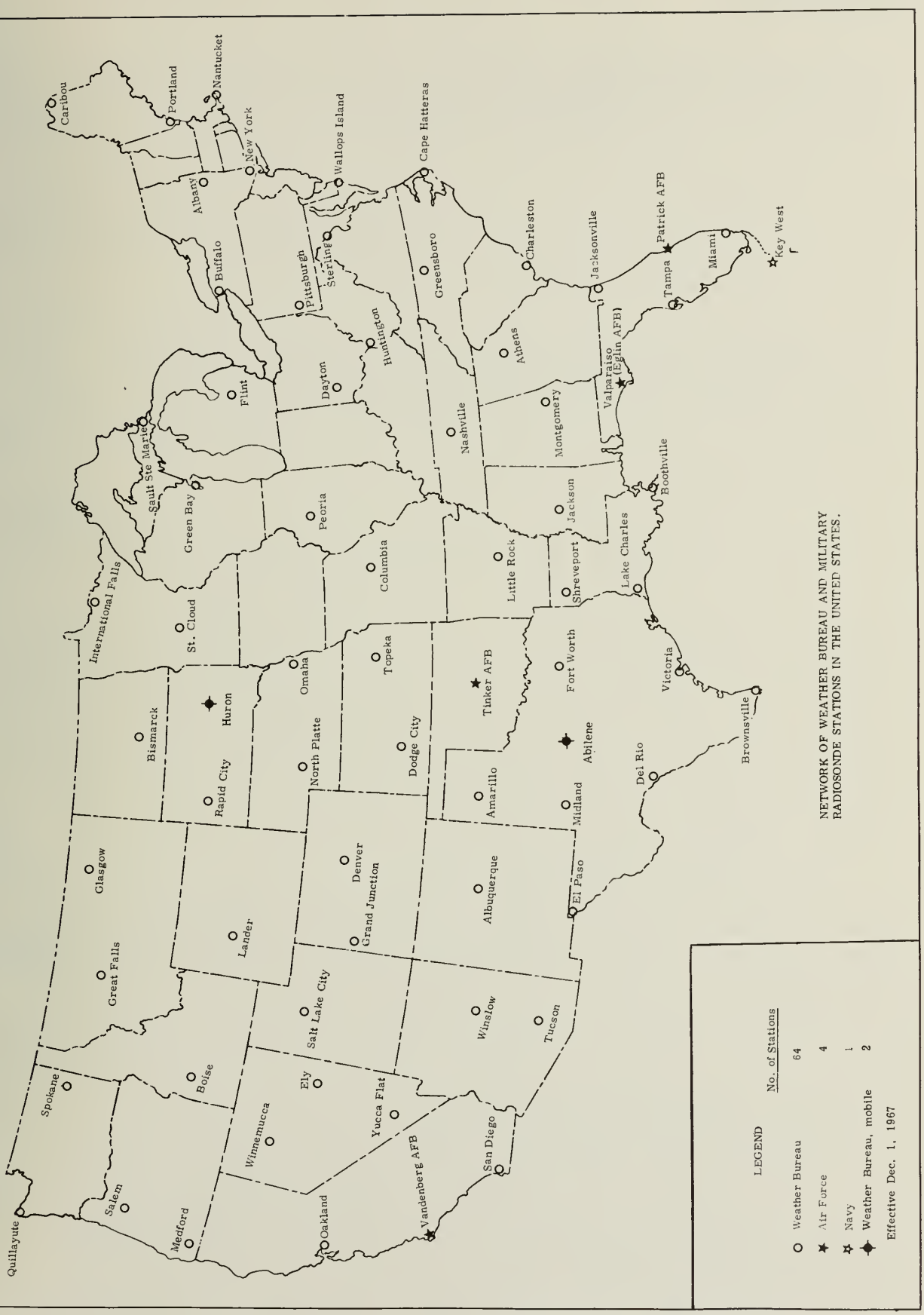
2. Radiosonde/Rawinsonde Observing Stations.

a. General. Radiosonde observations are scheduled twice daily, 0000Z and 1200Z, at the 69 stations in the domestic radiosonde network, Figure 14. These stations also take special observations when required and requested by the agency concerned. During the severe local storm season, the Weather Bureau has a mobile upper air station which operates at one of two locations. From February 1 to May 31, it is located at Abilene, Texas. Between June 1 and September 30 it is stationed at Huron, South Dakota.

Transponder capability is available at 33 stations to permit more accurate measurement of upper winds under strong wind conditions. The evaluated data from the routine soundings are transmitted over the Service C and Comet II teletypewriter systems in the regulation radiosonde code. Data from special soundings requested for potential or existing severe weather situations are transmitted via RAWARC, and other appropriate communications circuits to NSSFC and MWWC.

b. Non-network Stations. There are a number of other radiosonde stations, operated by various agencies, which take scheduled and unscheduled operations which might be potential sources of data under certain conditions. Table 1 lists the ones which may be useful to NSSFC or MWWC. Arrangements for data from these stations should be coordinated with the agency concerned by Weather Bureau Headquarters, DATAC Division by January 15 of each year. DATAC Division will work closely with NSSFC and MWWC when making these arrangements. Requests for special upper air observations from those non-network stations which have indicated they will take special observations will be limited to one or two soundings during any particular weather situation.

FIGURE 14. WEATHER BUREAU AND MILITARY UPPER AIR NETWORK



The Navy, Air Weather Service and Army take unscheduled and infrequent observations at a small number of training schools and mobile locations. However, due to the erratic availability of these observations, the agencies concerned do not deem it advisable to include all of them in this plan.

During the months of April, May and June when the National Severe Storms Laboratory (NSSL) and other agencies are usually engaged in intensive severe local storm data collection program in Central Oklahoma, upper air data are available from a number of upper air units in this area.

NSSFC should contact Weather Bureau Headquarters, DATAC Division during January of each year to see if and when such data will be available. NSSL has indicated that if a data collecting project is to be conducted, upper air data from some of these units could be furnished to NSSFC via RAWARC. Such soundings are usually terminated at 400 MB and coded in the regular upper air format. Most of the stations in this project will be taking hourly observations and the data is to be processed at a later date.

In 1969 a Weather Bureau unit at Chicasha, Oklahoma, an Army unit at Fort Sill and a number of mobile Air Force units at other points in Central Oklahoma will be operated in support of this program. Anticipated time for the upper air portion of the 1969 program is during the month of May.

When special network soundings are required they should normally be made at 18Z. The Director, NSSFC will initiate the request to Weather Bureau and NASA stations and the Commander, MWWC will similarily request soundings from DOD stations. While other Weather Bureau forecast centers have the authority to request special upper air observations during periods of potential severe storms of all types, requests for specials during periods of potential severe local storms should be made by SELS. Any cost involved in these special soundings will be borne by the requesting agency.

3. Surface Weather Observational Networks.

In order to provide the basic weather data for the analyses performed by NSSFC and MWWC all available surface data are used. Surface weather observations are collected from: (1) approximately 1203 land stations in the United States, and (2) 19 Automatic Meteorological Observing Stations (AMOS) of which seven are unattended, eight attended part-time and four full-time.

The land stations mentioned above may be placed in four general categories:

a. Approximately 310 Weather Bureau stations and Automatic Meteorological Observing Stations (AMOS).

b. 286 FAA weather reporting stations (FSS and TWRS).

c. 435 supplementary Aviation Weather Reporting Stations (SAWRS) including part-time paid and cooperative aviation and synoptic weather reporting stations and Coast Guard facilities.

d. 172 Department of Defense stations.

These stations take observations and transmit the coded observational data at regularly scheduled intervals. The transmissions are made hourly and even more frequently for aviation purposes, every three and six hours for synoptic map preparation and daily for climatological purposes.

4. Aircraft Reports (PIREPS).

a. Federal Aviation Administration (FAA).

(1) The present FAA regulations for PIREPS (Pilot Reports) are as follows:

> "Whenever he encounters a meteorological conditions in flight..., the knowledge of which he considers essential to the safety of other flights, the pilot in command shall notify an appropriate ground station as soon as practicable."

The following significant information should be included in PIREPS whenever it is observed.

(a) Moderate or greater turbulence.

(b) Hail encountered.

(c) Location of lines of thunderstorms observed on the airborne radar.

(d) Related maximum observed cloud tops of the thunderstorms.

(e) Location of tornadoes, funnel clouds and waterspouts.

(2) Air Route Traffic Control Centers (ARTCC) are requested to pass PIREPS to the Flight Service Station (FSS) which is required to place them on the Area B Circuit (Figure 15) for distribution to FAWS offices.

(3) The FAA will advise ARTCCs to expect a message on Area B Circuit from NSSFC requesting PIREPS from specified areas.

(4) NSSFC will attempt to obtain a receive only drop on ARTCC Center B Circuit for receipt of ARTCC reports of PIREPS.

b. Airline Meteorological Offices through Aeronautical Radio Inc. (ARINC).

(1) All pertinent PIREPS available to Chicago or Denver on ARINC circuits should be included in the PIREP summaries (UA) for transmission on Service "A", and thus made available to NSSFC.

TABLE 1. NON-NETWORK UPPER AIR STATIONS WHICH MIGHT BE SOURCES OF DATA

STATION	OPERATED BY	TIME OF OBSERVATIONS	DISTRIBUTION	AGENCY CONTACT	WILL TAKE REQUESTED SPECIALS
Marshall Space Flight Huntsville,Ala.	NASA	*See note.	Local loop to WBAS Huntsville, Ala. then to RAWARC	Bob Turner FTS 205-876-2767	Yes
San Nicolas Is. California Navy PMR Facility	NAVY Pacific Missile Range	Monday-Friday,00Z 12Z, 18Z Weekend and Holidays 00Z and 12Z	00Z and 12Z routinely on Service C. 18Z not transmitted.	Tom Carr commercial 805-982-7173 or 8508 Autovon: 8-898-1750-7173 or 8508	No. Will furnish 18Z data upon request.
Navy PMR Facility Pt. Mugu,Calif.	NAVY Pacific Missile Range	Daily, 1200Z. Unscheduled frequent soundings during missions	None	Same as above.	No. Will furnish unscheduled or 1200Z upon request.
Mississippi Test Facility Bay St. Louis, Miss.	NASA	*See note.	None	MIC FTS 601-688-3201 3202 3203	Yes
Chico,Calif.	USAF	Monday-Friday,15Z	Comet II	Commander, Det 58, 6th Wea Wg Autovon 831-1800 (Beal AFB) Extension 2383	No
Naval Air Technical Training Center Lakehurst, N.J.	US NAVY	Unscheduled	None	Supt. of AG Schools,Autovon 8-481-2228	Yes

*Observations are made on unscheduled basis, dependent upon operations.

TABLE I (Continued)

STATION	OPERATED BY	TIME OF OBSERVATIONS	DISTRIBUTION	AGENCY CONTACT	WILL TAKE REQUESTED SPECIALS
Vandenberg Boathouse (Sudden Ranch), Calif.	USAF	Daily, 06Z and 18Z	Comet II	Commander, Det 30, 6th Wea Wg (Vandenberg AFB) Autovon 898-1450 Extension 6900	Yes
El Centro, California	USAF	Monday-Friday to approximately 300 MB time variable	Comet II	Commander, Det 24, 6th Wea Wg (Edwards AFB) Autovon 898-1500 Extension 7431	No
Goodfellow AFB, Texas	USAF	Four days per week at 15Z or 21Z	Comet II	Commander, Det 31, 6th Wea Wg Autovon 885-3450 Extension 601	No
Edwards AFB, California	USAF	Monday-Friday Daylight hours, time variable	Comet II	Commander, Det 24, 6th Wea Wg Autovon 898-1500 Extension 7431	No
Cape San Blas, Florida	USAF	Monday-Friday 18Z	Comet II	Commander, Det 10, 6th Wea Wg (Eglin AFB) Autovon 899-1400 Extension 883-1322	No

TABLE 1 (Continued)

STATION	OPERATED BY	TIME OF OBSERVATIONS	DISTRIBUTION	AGENCY CONTACT	WILL TAKE REQUESTED SPECIALS
Ft.Bragg,N.C.	US ARMY	Unscheduled	Comet II	Commander, Det 3, 16th Wea Sq Autovon 935-3350. Ask for Wea Facility.	No
Ft.Benning,Ga.	US ARMY	Unscheduled	Comet II	Commander, Det 10, 16th Wea Sq Autovon 431-1410. Ask for Wea Facility.	No
Ft.Sill,Okla.	US ARMY	Unscheduled	Comet II	Commander, Det 11, 16th Wea Sq Autovon 883-1410. Ask for Wea Facility.	No
Ft.Hood,Texas	US ARMY	Unscheduled	Comet II	Commander, Det 14, 16th Wea Sq Autovon 737-2131. Ask for Wea Facility.	No
Ft.Carson, Colo.	US ARMY	Unscheduled	Comet II	Commander, Det 58, 16th Wea Sq Autovon 329-0111. Ask for Wea Facility.	No
Ft.Huachuca,N.M.	US ARMY	Unscheduled	Comet II	C.O. Met Team U.S.A.Electronics Comd. Autovon 320-1110. Ask for Met Team.	No
Yuma Test Station, Ariz.	US ARMY	Unscheduled	Comet II	C.O. Met Team U.S.A.Electronics Comd. Autovon 898-3600. Ask for Met Team.	No

FIGURE 15

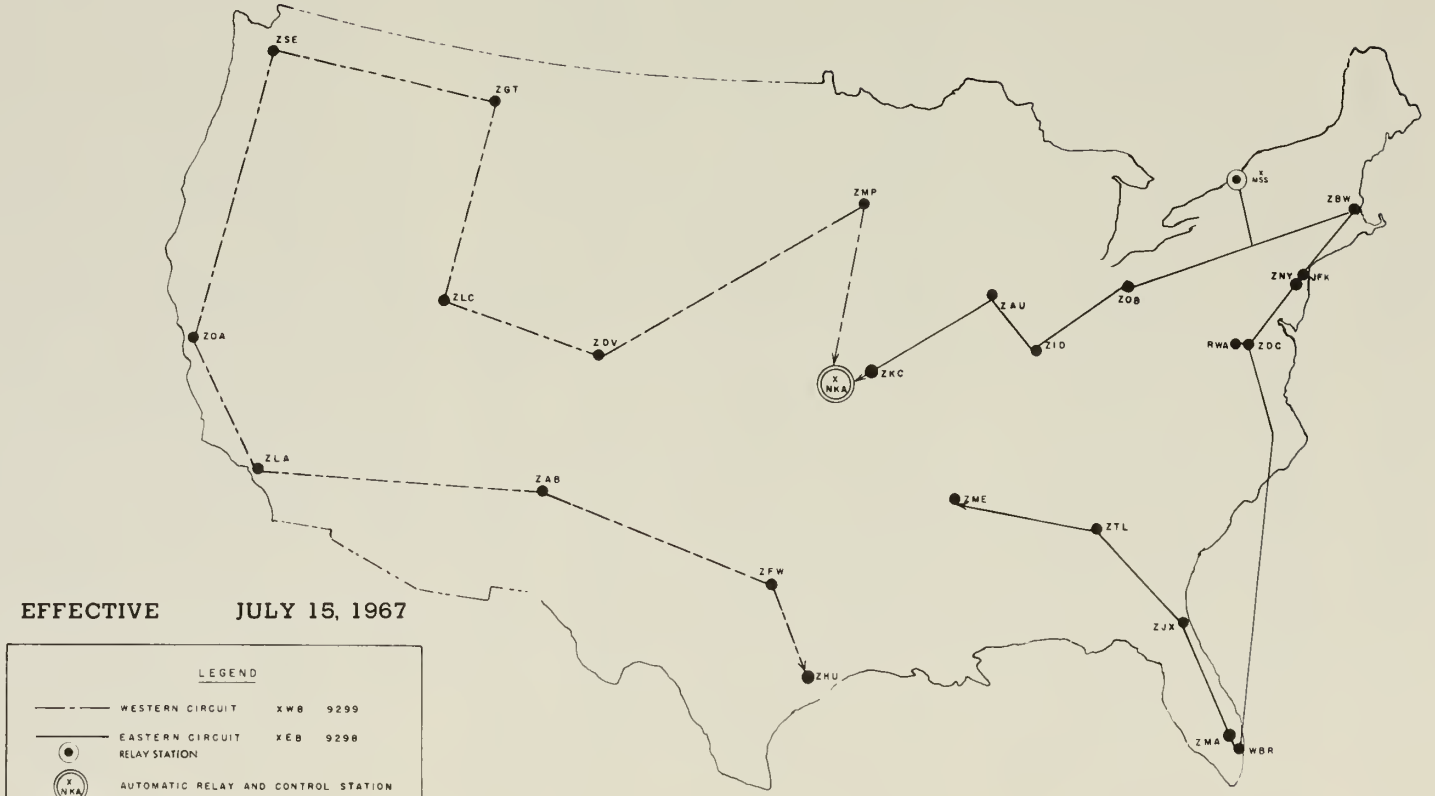
DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

AIR TRAFFIC SERVICE

SERVICE B TELETYPEWRITER SYSTEM

CENTER B 9298 - 9299



EFFECTIVE JULY 15, 1967

LEGEND

WESTERN CIRCUIT XWB 9299

EASTERN CIRCUIT XEB 9298

RELAY STATION

AUTOMATIC RELAY AND CONTROL STATION

SEND-RECEIVE DROP

CLU 000-1010Z DAILY

CHAPTER 5

5. Severe Storm Surveillance by Meteorological Satellites.

Several types of data will be available from the various operating meteorological satellites during the 1969 severe local storm season. A description of the data and their availability is given below.

a. Automatic Picture Transmission (APT).

Pictures from the APT systems on the satellites ESSA 2 and ESSA 6 will be available at a number of Weather Bureau, U. S. Air Force, and U. S. Navy stations having appropriate ground equipment when the satellite is in range of the station. The ESSA APT satellites are in a picture taking mode on a southbound track. At the beginning of the severe local storm season the time of the pictures will be near 0540 local standard time for ESSA 2 and 1035 local standard time for ESSA 6 during the storm season. These pictures are gridded manually as soon as they are received and are available to the meteorologists almost immediately.

The camera systems on these satellites are degrading so a replacement is expected to be launched early in 1969. NASA is also planning to launch another Nimbus R&D satellite late winter or early spring. It will carry an APT system. TIROS M, a prototype of the "third generation" of operational polar orbiting satellites, is scheduled to be launched in mid-1969. The APT, both visual and infrared, and AVCS capabilities will be combined into a single spacecraft. Information concerning the above launches will be provided to the Regional Headquarters as soon as it is available.

APT cloud imagery will also be transmitted over a facsimile network (FOFAX) The acquisition will be made at Wallops Island, San Francisco, and Honolulu.

APT data will be available to anyone having a suitable recorder by merely obtaining a connection to the facsimile network. The APT imagery will require manual gridding as before.

b. Advanced Vidicon Camera System (AVCS).

The AVCS pictures of the satellite ESSA 7 are stored on a satellite borne tape recorder and are collected at the NESC via one of the two Command and Data Acquisition (CDA) stations (Gilmore Creek, Alaska; Wallops Island, Virginia). These pictures are taken during the northbound track of the satellites. At the beginning of the severe local storm season the pictures from ESSA 3 will be near 1245 local standard time while those from ESSA 5 will be near 1615 local standard time. The pictures over the storm area of North America will be acquired at the Alaska CDA station ten to fifteen minutes after they are taken. Immediately upon receipt these signals are relayed to the NESC where they are converted into photographic data. The pictures are available to the NESC and NMC meteorologists for analysis and interpretation about one to one and half hours after they are taken.
The AVCS video cloud data is processed in the CDC-6600 computer at Suitland to produce digitized mosaics in a convenient facsimile format in polar and

mercator projections. The digitized mosaics are transmitted on all facsimile circuits. Nephanalyses are also prepared from these pictures and are transmitted over the various facsimile networks a few hours later.

c. Applications Technology Satellite (ATS).

The Applications Technology Satellite program is a research and development program of the National Aeronautics and Space Administration. Two satellites of this series equipped with meteorological sensors are in earth synchronous orbit. The ATS-1 satellite is located over the Central Pacific Ocean. Request has been made to have ATS-3 satellite located near 95°W over the equator until late Spring 1969. In this position the severe local storm areas of North America will be in excellent range of the satellite's cameras. NESC will assume control over the spin-scan camera on ATS-1 on February 1969 and ATS-III late 1969.

There are two camera systems being tested on ATS-3. One is the three color spin-scan camera system which is capable of taking a color picture at intervals of about twenty-four minutes. The other is the Image Dissector Camera System using an electronic scanning technique. Its pictures are black and white and can be taken at intervals of about thirteen minutes.

Since these satellites are operated by NASA as research and development experiments, plans for the operational use of these ATS-3 pictures are very tentative. It is possible that a series of pictures can be made available to NESC and NMC meteorologists on a slightly delayed basis. Steps are underway to provide a more systematic operational procedures. The most important use of these pictures will be for investigating storm development and movements on a research basis. The results of these investigations will be useful in operational applications of this type of data when it is eventually incorporated into the operational system.

6. Severe Local Storm Actions of Non-Meteorological Agencies and Individuals.

The Weather Bureau utilizes the observations of severe local storm activity, particularly tornadoes, from many non-meteorological agencies and personnel such as: utility companies; State Highway Patrols; Local Police Departments; road maintenance patrols; citizen spotters (networks); cooperative Weather Bureau climatological observers; Citizen Band Radio groups; Local Civil Defense organizations; radio and TV station mobile units; city employees (example: Chicago Sanitary District); FAA and individual citizens.

Reports are received by various means which are not uniform at each WB station, including Citizen Band or CD radio facilities (with a transceiver often located in the WB station and manned by local cooperators) police radio, direct telephone lines involving unlisted numbers, NAWAS, Highway Patrol teletype circuits via telephone or their sending "drop" on state ESSA Weather Wire Service circuits and Service "A" teletypewriter circuits.

Reports are disseminated to mass news disseminators, other WB offices and safety agencies by ESSA Weather Wire Service (1st priority, except for a more expedient means in some local areas), RAWARC, National Warning System (NAWAS), telephone (hot lines and commercial), ESSA-WB VHF-FM installations, direct radio broadcasts, telephone recordings and CD radio facilities. The "fan-out" principle is utilized wherever practical.

PUBLICITY

The Military Weather Warning Center advisories and point warnings are designed for specialized military users and shall not be released to the public. News media releases, that concern the cooperative efforts in severe storms activities of the Department of Defense, ESSA Weather Bureau, and other agencies should reflect the joint nature of these efforts by giving due credit to participating agencies. Copies of these releases should be forwarded to:

Special Assistant for Environmental Services
The Joint Chiefs of Staff
Washington, D. C. 20301

Department of the Army
Office of the Assistant Chief of Staff for Intelligence
Attention: ACSI-TE
Washington, D. C. 20310

Headquarters, Naval Weather Service Command
Building 200
Washington Navy Yard
Washington, D. C. 20390

Headquarters, Air Weather Service (AWFOI)
Scott Air Force Base, Illinois 62225

ESSA, Public Information Office
6001 Executive Boulevard
Rockville, Maryland 20852

ANNEX 1

COLLECTION AND DISTRIBUTION OF WEATHER BUREAU RADAR REPORTS

Except for one location, Sacramento, California, Weather Bureau radar information is collected and distributed on RAWARC (RAREP and Warning Coordination teletypewriter network). Data from Sacramento are appended to the hourly surface observations and sent on appropriate Service A circuits.

RAWARC, Figure 6, is a landline teletypewriter network consisting of four circuits which terminate at Kansas City, the network relay and monitoring station. During the hurricane season, a few stations not normally on RAWARC are also added. Traffic on RAWARC is basically unscheduled and is handled according to a priority system. The only regularly scheduled operation on RAWARC is an hourly collection (H+45) of Radar Reports (SD). Special radar reports can be transmitted at any time the circuit is not in use.

ANNEX 2

ESSA WEATHER WIRE SERVICE

The ESSA Weather Wire Service (EWWS) consists of (a) local loops serving metropolitan areas, (b) statewide intrastate circuits, and (c) overlay circuits. The purpose of the EWWS is to transmit consumer-oriented forecasts, watches, weather warnings and meteorological data to the mass news media for broadcast to the public. Various specialized users also obtain drops on the EWWS to meet their requirements.

Each intrastate circuit has one Weather Bureau location designated as the State Relay Center (SRC). The SRC is also connected to the regional overlay interstate circuit and serves as the relay point for transmissions to other states through the SRC's. In each region, one station has been designated as a regional relay station. This station is responsible for the relay of traffic between overlay circuits.

Only Weather Bureau offices (or certain other authorized offices) have direct entry on these circuits. Forecast centers furnish broad-scale information, while local Weather Service Offices enter local information. Relays between adjacent circuits are established as necessary to meet the requirements of the Weather Bureau's severe local storms warning service and subscribers located along state or area borders. When urgent material, such as a warning is transmitted, a prearranged bell signal is used to attract the attention of users to the transmission.

Figure 7 shows the areas covered, SRC's, regional overlay circuits and regional relay centers.

ANNEX 3

ADC RADAR SITES AND ASSOCIATED DIVISION WEATHER STATIONS

1. Baudette AFS, Minn. 48-40N 94-37W	29AD, Duluth, Minnesota
2. Blaine AFS, Washington 48-55N 122-44W	25AD, McChord AFB, Washington
3. Calumet AFS, Michigan 47-22N 88-10W	29AD, Duluth, Minnesota
4. Cape Charles AFS, Virginia 37-08N 75-57W	33AD, Ft. Lee AFS, Virginia
5. Charleston AFS, Maine 45-05N 69-06W	36AD, Topsham AFS, Maine
6. Ellington AFB, Texas 29-37N 95-10W	31AD, Oklahoma City AFS, Oklahoma
7. Fallon AFS, Nevada 39-24N 118-43W	26AD, Adair AFS, Oregon
8. Finland AFS, Minnesota 47-27N 91-14W	29AD, Duluth, Minnesota
9. Fort Fisher AFS, N. C. 33-59N 77-55W	33AD, Ft. Lee AFS, Virginia
10. Fortuna AFS, N. D. 48-54N 103-52W	28AD, Malmstrom AFB, Montana
11. Havre AFS, Montana 48-53N 109-57W	28AD, Malmstrom AFB, Montana
12. Keno AFS, Oregon 42-04N 121-58W	26AD, Adair AFS, Oregon
13. Lackland AFB, Texas 29-24N 98-38W	31AD, Oklahoma City AFS, Oklahoma
14. Mt. Laguna AFS, California 32-53N 116-25W	27AD, Luke AFB, Arizona

ANNEX 3 (Continued)

15.	North Truro AFS, Mass. 42-02N 70-03W	35AD, Hancock Fld, New York
16.	Othello AFS, Washington 46-43N 119-11W	25AD, McChord AFB, Washington
17.	Palermo AFS, New Jersey 39-13N 74-41W	33AD, Hancock Fld, New York
18.	Perrin AFB, Texas 33-42N 96-39W	31AD, Oklahoma City AFS, Oklahoma
19.	Port Austin AFS, Michigan 44-02N 83-00W	34AD, Custer AFS, Michigan
20.	Sweetwater AFS, Texas 32-28N 100-28W	31AD, Oklahoma City AFS, Oklahoma
21.	Tyndall AFB, Florida 30-05N 85-37W	32AD, Gunter AFB, Alabama
22.	Waverly AFS, Iowa 42-41N 92-29W	29AD, Sioux City AFS, Iowa

MWWC can contact all Division weather stations by calling the 10AF Switchboard, Richards-Gebaur AFB, Missouri, and asking for appropriate Division. After getting the desired Division, ask for 765 or 766, which will give them the forecaster at all Division stations, with the exception of the 31AD, Oklahoma City AFS, Oklahoma. The extension for the 31AD is 721.

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